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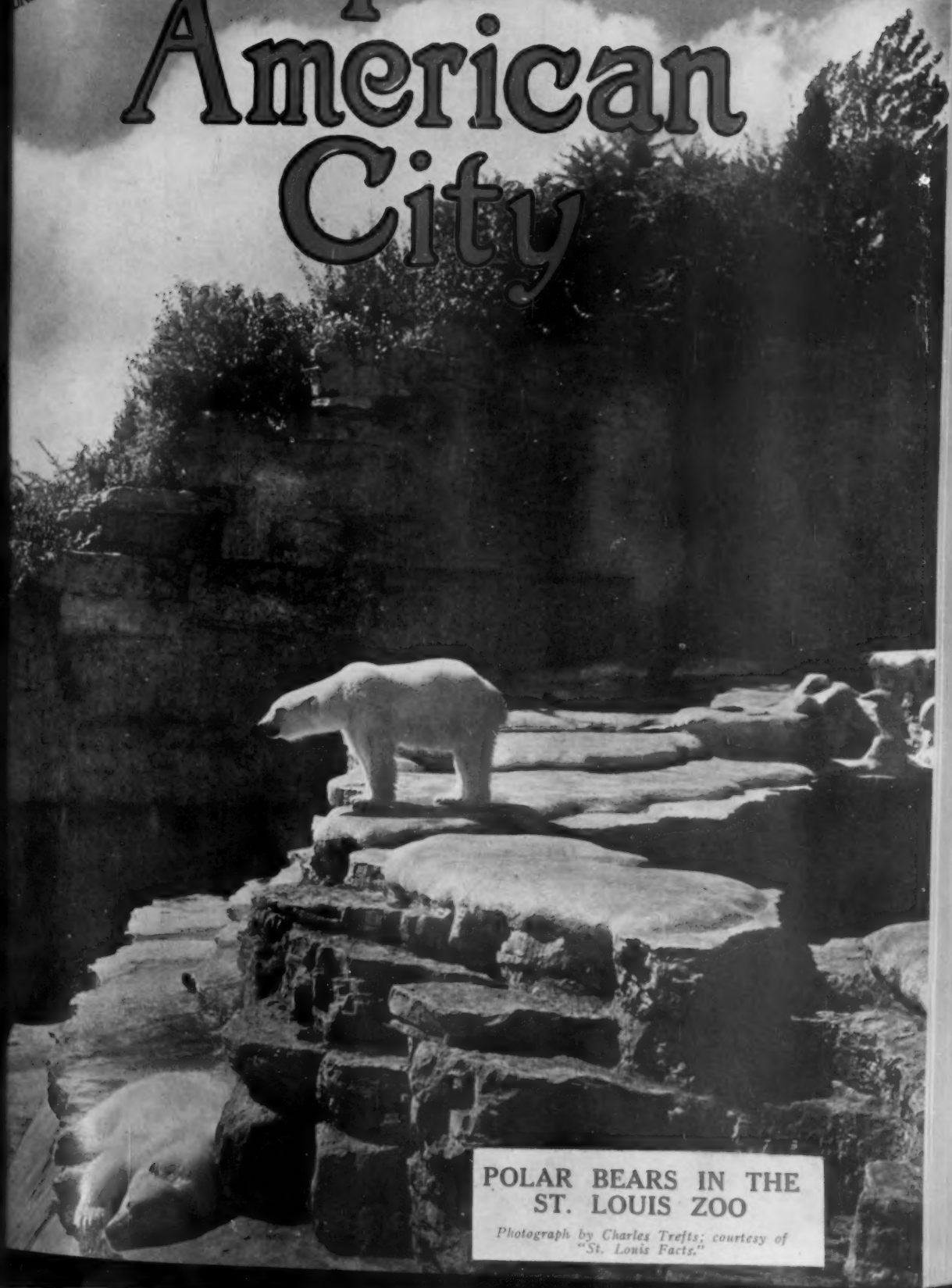
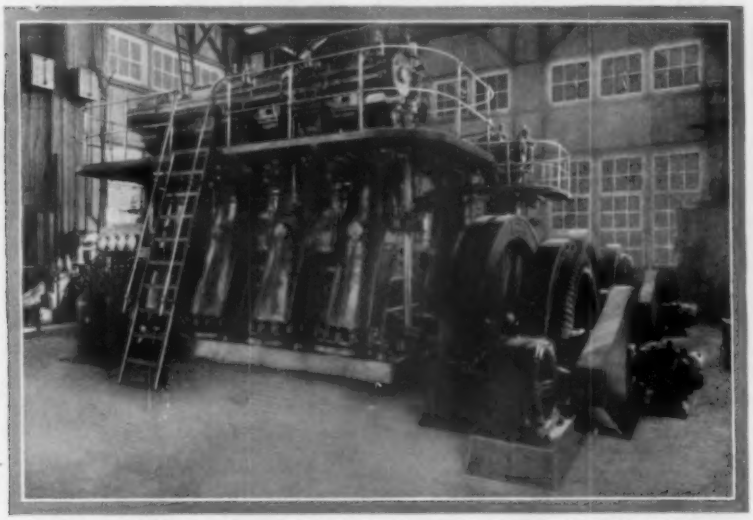


POLAR BEARS IN THE ST. LOUIS ZOO

Photograph by Charles Trefts; courtesy of "St. Louis Facts."

FULTON DIESEL



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Entered as second-class matter, July 29, 1910, at the Post Office at New York, N. Y., under Act of March 3, 1879

Issued Monthly by The Civic Press, 443 Fourth Ave., New York. Printed in U. S. A.

Vol. XXXII
No. 3

The American City Magazine

MARCH
1925

443 Fourth Ave.
NEW YORK

50 Cents
$4 a Year

Findings of Safety Conference Receive Nation-wide Consideration

By Herbert Hoover

REAL progress is being made toward better control of traffic to prevent accidents since the recent conference of public officials and voluntary agencies from all parts of the country upon street and highway safety.

Legislation to improve safety on the highways has been introduced into 38 state legislatures since January first. The various classes of legislation and the number of states in which each class has been introduced can be summed up as follows: licensing of drivers, 11 states; driving while intoxicated, 17; failure to stop after accident, 6; speed, 12; impounding or confiscation of the car as a penalty for violations of the motor vehicle law, 2, and for transporting liquor or other illegal use, 7; compulsory stopping at railroad crossings, 12 (one legislature is considering a bill to repeal an existing railroad crossing stop law); certification of title, 10; compulsory automobile insurance or bond, 20.

The adoption of this legislation would increase to 23 the number of states which require that all drivers of motor vehicles shall be licensed; fourteen more states would require licenses for drivers of vehicles for hire; while there would remain 11 states without operators' license laws of any kind. Twenty-two states would require some sort of examination before the issuance of license to the applicant.

The National Conference on Street and Highway Safety* after thorough consideration of methods for controlling incompetent and reckless drivers, was unanimously of the opinion that "no unlicensed person should be permitted to operate a motor vehicle." It also stated emphatically that "the department or division administering the motor vehicle law should have full authority to refuse an operator's license to any person and to suspend or revoke a license already issued for any reason deemed sufficient." It also called for determination of the applicant's "physical and mental fitness and his knowledge of the laws and * * * * an actual demonstration of his ability to operate a motor vehicle." It recommended that the minimum age limit be fixed at sixteen years and that "no person who cannot read English should be permitted to operate a motor vehicle."

For Safer Streets and Highways

In this statement Secretary Hoover outlines some of the forward steps already taken by states and cities to make effective the recommendations of the National Conference on Street and Highway Safety, held in Washington December 15 and 16. Municipal officials and local civic organizations are cooperating very generally in this nation-wide effort to secure important practical results from the work of the Conference.

State and Local Conferences

Another indication of the public attention now being given to street and highway safety is the inauguration of state and local confer-

* See THE AMERICAN CITY for January, 1925, pages 25 to 32.

ences and the appointment of state commissions to consider the problems involved.

In Massachusetts, Governor Fuller called a state-wide conference, which was participated in by state officials, mayors, chiefs of police, chambers of commerce, motor clubs, the Massachusetts Safety Council, and other organizations. In Michigan, Governor Groesbeck organized a similar conference. In Missouri, plans are being made for a street and highway conference of city and state officials, a large number of private organizations, women's clubs and newspaper editors. These conferences have for their avowed purpose the application of the findings and conclusions of the National Conference in the states and localities concerned.

In Rhode Island, the State Board of Public Roads in its report to the General Assembly refers to the work of the National Conference and urges the inclusion in legislation of the policies recommended dealing with investigation of accidents and revocation of licenses as punishment for violators. In Oregon, a joint resolution introduced in the State Legislature would create an official committee to cooperate with similar committees in adjoining states with a view to developing uniformity of laws and regulations, while the Eastern Conference of Motor-Vehicle Administrators, consisting of the commissioners of motor vehicles of twelve eastern states and the Canadian provinces of Ontario and Quebec, at its quarterly meeting in Harrisburg in January, adopted a resolution "heartily endorsing the activities of the National Conference on Street and Highway Safety." Information from Texas states that a new highway legislative code, based on the conclusions and recommendations of the Conference, will be submitted to the next Legislature. Officials of Nevada have advised that proposals are being made for revision of the state automobile license law along similar lines.

In addition to state activities, movements are being started in a large number of cities for carrying out the recommendations of the Conference for the cooperative organization of communities for public safety. While many of these cities have had safety programs in the past, these are being revised in an effort to have them conform to the national program as far as local conditions will permit.

At the present time 12 states have laws requiring the certification and registration of automobile titles, while similar laws are being introduced in the present sessions of the legislatures of four others. The Conference designated this class of legislation as "one of the most important and effective means for reducing thefts, and, by virtue of this result, owing to the relation between the theft and accident hazards, also a measure for improving the present public accident situation."

State Paternalism and Municipal Budgets

A PENNY-WISE political gospel that appears to regard economy as the virtue most to be desired in American public life finds striking exemplification in an attempt now under way in New Jersey to curb "municipal extravagance" through paternalistic control by the state. If bills now before the Legislature are enacted into law, the profound wisdom of a state board—endowed, no doubt, with ominiscience and omnipresence—is to be invoked to inquire into local budgets and proposed bond issues for county, municipal or school purposes and to make reductions where appropriations are shown to be "unwise, unnecessary or excessive." The power proposed would be exercised upon petition of 25 or more taxpayers in any locality; and the state board, after a hearing, would issue "an order, either affirming the budget or appropriations under review, or decreasing the same or any item thereof."

This proposed legislation for New Jersey is modeled on the so-called Indiana plan, under which ten taxpayers in any municipality can bring about a review of their local budget by the State Board of Tax Commissioners. After a hearing this board has authority to approve or reduce the tax levy, and its decision in the matter is final.

At the annual convention of the New Jersey State League of Municipalities, held in Newark February 6, a discussion of this proposal was one of the principal items of business. Secretary Sedley H. Phinney had communicated some months previously with several Indiana mayors as to their practical experience with state control of local budgets. Among the replies—all of them unfavorable—was the following interesting comment by Mayor William H. Elmendorf of Evansville:

"We have just passed through an experience covering our budget for next year. This has to be filed not later than September 15. In preparing our budget we have one preliminary meeting and two council meetings. The newspapers give us a

lot of space. We invite taxpayers to attend and express their views. In addition to this we telephone the officials of possibly twenty civic organizations, and at the first meeting we had present eight citizens besides the officials. These gentlemen went over the matter in detail with us and at the conclusion of the meeting expressed themselves as satisfied with the amount asked. They stated that, while they sought to hold down taxes, they were not in favor of starving a city so that it could not keep up with its program of development and growth, the rendering of public service, the maintaining of our park system and the preserving of city property in general.

"That budget was attacked and remonstrance was filed by twenty men who represented themselves as taxpayers. We found on investigation that three of the remonstrators lived outside of the city limits and paid no taxes in the city; five others were non-taxpayers. Out of twelve who were taxpayers, three paid on personal property only—on $300, $180, and $150 respectively. The entire twelve, if they pay their taxes this year, will pay into the treasury $182.97, scarcely enough to pay the cost of the hearing, for even though the city of Evansville pays nothing for these hearings, the state of Indiana does, which means that the taxpayers of Indiana do. Of the twenty who signed, but two of the remonstrating taxpayers appeared at the meeting; a third party, a non-taxpayer, who appeared because he had an equity in a small undivided estate in the city, made the most noise.

"I believe that the State Tax Board is a useful body in many respects, but I also feel that local officials should be permitted to manage local affairs without interference, because they are answerable to the people; the tax commission is answerable to the government of the state."

The attitude of the New Jersey mayors and other local officials towards the adoption of the "Indiana plan" was made plain by unanimous approval by the Newark convention of a resolution opposing the proposed legislation for reasons, among others, as follows:

"Under the admirable requirements of the New Jersey municipal finance laws, generally recognized as models throughout the United States, there is already ample opportunity for the general public to influence local budgets through the required publication in the newspapers and the budget hearings, the public usually not taking the trouble to attend these hearings.

"The proposals of Assembly Bills 155 and 157 are likely to permit irresponsible individuals to make complaints, resulting in intolerable delay in the adoption of the necessary financial programs and costing the state large sums of money for investigators and hearings to travel about the state, and learn facts at second-hand that are already better known to the local officials, thus resulting in greater expense to the taxpayers instead of relief.

"The proposals . . . are a denial of the home rule principle and would remove from local elective officials the powers and the responsibility for the administration of their duties and place them in the hands of a distant board in whose appointment political considerations may prevail, thereby diffusing power and permitting officials to evade responsibility."

It is not believed that the threatened legislation will be enacted in New Jersey; but the very proposal—which is understood to have the backing of the Governor—is evidence of the need for the most intelligent efforts of municipal officials everywhere, not merely to eliminate waste and inefficiency where such exist in local government, but to demonstrate to the voters and state legislators the ultimate economy of liberal expenditures for public improvements under wisely enacted home rule legislation.

The current propaganda on tax "burdens" should be countered with a campaign of education as to tax *benefits*. "Wiser, not smaller, municipal expenditures" should be the slogan of most of our progressive American cities in this twenty-fifth year of the twentieth century.

The Great To-Do Over Increased Public Expenditures

THERE is a great to-do over the announcement of the Census Bureau that between 1912 and 1922 the public debt, national, state and local, increased from $4,850,460,000 to $30,845,260,000, or nearly seven times. Governmental extravagance must stop! Taxes must be reduced! But let us pause a moment for analysis. The increase of the national debt, from $1,028,564,000 to $22,155,886,000, was caused chiefly by war bonds; the remainder of the growth, if increase in population and rise in price level are accounted for, was smaller than was to be expected. State debts totaled about $346,000,000 in 1912. The population increased 11.5 per cent during the next decade, and an equivalent enlargement of debt would have brought it nearly to $400,000,000. In 1920 the price level was more than double that of 1912, but if we assume that the net increase of the debt due to higher prices was only 50 per cent, the total would have become $600,000,000 in 1922. As a matter of fact, it was $935,000,000—a real growth of but 55 per cent per capita. Similar analysis of local indebtedness shows the real increase per capita to have been only 30 per cent. And both percentages represent enormous increase in equipment for productive service, such as roads and schools. The real test of public expenditures is not simply what we pay in taxes, but what we get for what we pay.

—From *The New Republic* for February 4, 1925.

St. Louis and Zoo Construction

What the Next Few Years Will Bring Forth

By Henry D. La Cossitt
Assistant Editor, "*St. Louis Facts*"

THE St. Louis Zoo, so far as construction is concerned, is ahead of the world. This statement is not extravagant. It is substantiated by Lorenz Hagenback, eminent authority on zoos, who, on a recent visit to the St. Louis garden, was much impressed by the latest addition to it, a magnificent Primate House.

It has been the plan of the authorities of the St. Louis Zoo to build the structures and then obtain specimens to fill them, rather than to acquire immense collections and house them in temporary quarters. At present there are 64 species of animals represented by 230 specimens, and 132 species of birds represented by 706 specimens.

The Primate House, an ornate structure of Moorish design, is part of the immense construction program now in execution. The Bird Cage, made famous by the Louisiana Purchase Exposition, was the first construction and was really the nucleus for the modern Zoo. The Lion House, however, was the first of the modern buildings to be built. In this are housed all the large felines. Next came the construction of the Elephant House and then the building of the famous Bear Pits, which have been copied throughout the world. The

EDITORIAL NOTE.—The American City is indebted to Nelson Cunliff, Editor of "St. Louis Facts," and to Charles Trefts, photographer, for the front cover view and the other photographs here reproduced. Those on this page show the Lion House, the Seal Pond, and feeding-time in the Bird Cage. On the opposite page are the portraits of some of the Zoo's most distinguished inhabitants.

Miss Jim ~ Indian Elephant

Gretchen ~ Lioness

Steve ~ Hippo

Prince ~ Bengal Tiger

Louie ~ Lion

Black Buck of Africa

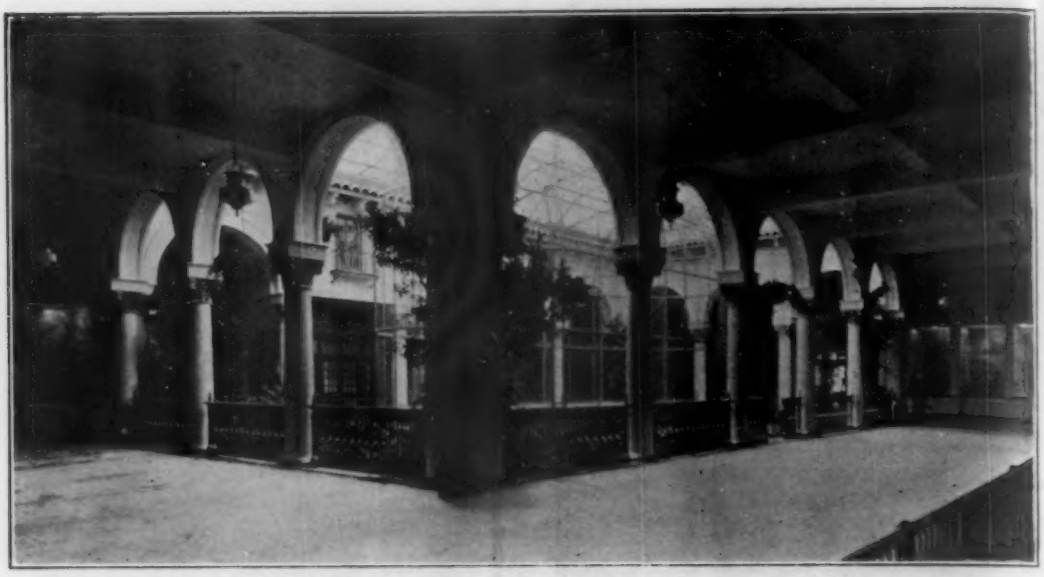
Llama

Peninsula Bear

Musk Ox

White Fallow Deer

Chimpanzees



INTERIOR OF NEW MONKEY HOUSE AT THE ST. LOUIS ZOO

Primate House followed these and was opened January 14, 1925.

The program for the next few years is pretentious, and its consummation will place the St. Louis Zoo far ahead of the rest of the world. An Aquarium excelling those in New York and San Francisco, will be built. A new Lion House (for winter quarters only) and Feline Pits will take the place of the present Lion House. The Feline Pits will be patterned after the Bear Pits and will allow the animals the freedom of the open air. A Goat Mountain of huge proportions, and a Bird House, to be used as winter quarters, will also be constructed.

The modern St. Louis Zoo is but fifteen years old. It is managed by a Zoological Board of Control, composed of nine members and a secretary. Five of the members are city officials and the remaining four usually public-spirited citizens who have fostered the Zoo.

Working in conjunction with this control is the Zoological Society of St. Louis, an association of 3,300 members. The president of this organization is George E. Dieckman, who was recently elected president of the National Zoological Society.

The Zoo is maintained by a tax of one-fifth mill on the dollar, which brings about $230,000 per year. This fund makes a definite plan of progress possible, as each year there is a substantial surplus with which to make improvements.

A Locomotive Engineer Writes on Grade-Crossing Accidents

To the Editor of THE AMERICAN CITY:

I have just read the comments in your November issue on plans for fewer deaths at railroad crossings. As an engineman of 13 years' experience, I have watched this crossing business from the cab of an engine and have also studied it from the driving-wheel of my own car. Here are my conclusions:

First, no one should be allowed to run an automobile until he has passed a rigid examination of his eyesight and hearing and physical condition. Then the applicant for a license should have to spend from one to four hours per day under the direction of a very competent driver for a period of three months, and also pass written and oral examinations on state and local traffic laws and regulations.

With our laws and the rules of our railroads requiring a locomotive engineer to have fired for three years and then pass a rigid examination and show familiarity with all modern safety appliances, should not our laws require a much stricter examination than at present of the drivers of automobiles?

In my opinion, no person under the age of 21 ought to be permitted to drive a car unless accompained by a guardian, except by special permit after having successfully passed all of the above-mentioned examinations. I would much rather run a locomotive and handle a hundred freight cars over a track I had never been over before, than drive an automobile amidst the traffic conditions caused by the carelessness or ignorance of the large majority of our car owners and drivers.

K. E. RUTLEDGE.
Portland, Ore.

EDITORIAL NOTE.—THE AMERICAN CITY is glad

to publish Mr. Rutledge's letter, not with any idea that so strict requirements as he advocates for automobile licenses will ever be adopted, but with the conviction, nevertheless, that in many of our states present requirements in this matter are far too lax. Indeed, according to a recent statement of the National Safety Council, fourteen states have no drivers' license law of any sort, and several others issue licenses without examining applicants. Terrible as is the toll of accidents by railroads at grade crossings, the deaths from that cause are less than one-seventh as many as from automobile accidents on streets and highways—and our laws throw much the fewer safeguards around the greater public danger.

The National Conference on Street and Highway Safety, held in Washington, December, 1924, recognized the need for stricter licensing and impounding laws by adopting the following recommendations:

Licensing of Drivers

No unlicensed person should be permitted to operate a motor vehicle. A reasonable length of time after the passage of the law requiring operators to be licensed should be granted operators already qualified in which to secure licenses without examination. The department or division administering the motor-vehicle law should have full authority to refuse an operator's license to any person and to suspend or revoke a license already issued for any reason deemed sufficient.

Before granting an operator's license, the department or division should determine the applicant's ability to operate a motor vehicle safely, by ascertaining his physical and mental fitness and his knowledge of the laws, and by requiring an actual demonstration of his ability to operate a motor vehicle. It is recommended that all states designate the minimum age limit, but that no person under sixteen years of age, and no person who cannot read English, should be permitted to operate, drive or direct a motor vehicle.

Penalties

Reckless driving and any other flagrant disregard of the rights of others by any user of the streets or highways should be vigorously and unceasingly prosecuted. There should be legislation providing adequate penalties for infractions of traffic rules, including mandatory suspension or revocation of licenses for a specified length of time for cumulative evidence of carelessness or irresponsibility, for operating a motor vehicle while under the influence of intoxicating liquor or drugs, or for other serious offenses against the motor-vehicle law, and severe penalties for driving during the period of suspension or revocation; there should be a sufficient number of organized traffic officers to detect and prosecute such infractions; and there should be cooperation between states for the enforcement of the laws in each state.

The law with respect to motor vehicles should provide that when any motor vehicle is operated with gross negligence or recklessness, in violation of the provisions of the general motor-vehicle law, resulting in serious injury to persons or property, where such violation has been established by due process of law, the registration of the car should be suspended or revoked and its number plates be removed or other means of prohibiting use of the vehicle instituted for a period depending on the seriousness of the offense.

Development of Landing Fields and Airports

From a Bulletin on Aeronautical Progress, Issued Feb. 12, 1925, by the Transportation and Communication Department of the Chamber of Commerce of the United States

THE development and extension of aeronautics depend upon proper landing facilities, the cost of which is an important factor. It is therefore essential that this problem receive timely and thorough consideration by the various interests concerned in any given locality, including commercial organizations, aeronautical enterprises, the Post Office authorities (on existing or proposed *air mail* routes) and the Army and Navy Air Services (where the interest of the national defense is involved).

The approximate number of landing fields or airports already established in the United States is reported by the Airways Section of the Army Air Service to be as follows:

Army	93
Navy	17
Air Mail	46
Municipal	226
Commercial	208
Emergency and unimproved	2,618

In addition to these, there are in the United States 89 airports provided with seaplane facilities.

Commercial organizations or concerns considering the establishment of air terminal facilities, or desiring to reserve an appropriate tract of ground with a view to developing such facilities when the need arises, can secure information and assistance on application to the Army Air Service, War Department Washington, D. C. Among the materials issued by the Airways Section are the following:

(a) A map entitled "Landing Facilities and Proposed Airway System in the United States, 1924"
(b) A series of bulletins known as the "Route Information Series" giving flying directions for all the principal routes shown on the above-mentioned map
(c) A series of bulletins known as the "State Series," showing landing facilities in the various states and detailed descriptions of landing fields where available
(d) A circular entitled "How An Airport Should Be Built"
(e) A circular entitled "Emergency Landing Fields"
(f) A circular entitled "The Airport"
(g) A blue-print entitled "Types of Ideal Landing Fields"
(h) A sample form for report on individual landing fields

Transit Tie-up Laid to a Rat

TO the transmission of bubonic plague and his many other accustomed depredations, there was added, on February 2, a unique achievement of the rat. By gnawing through the insulation in a 30,000-kilowatt generator in the main Interborough power-house in New York, a rat is believed to have caused what proved to be one of the most complete subway tie-ups in the history of the city. According to the *New York Times*, "direct evidence that the gnawing of a rodent at the rubber insulating compound covering a wire had caused the trouble was unobtainable, as the rat, if existent, would have had 120,000 kilowatts of electricity, the load the station was carrying at that time, and would have been cremated and then vaporized by the intense heat.

The More Economical Design of Brick Pavements

By Willis D. P. Warren
Holbrook, Warren and Van Praag, Decatur, Ill.

IT is recognized that the proper design of a brick pavement involves many features, and also problems which can be finally solved only upon the completion of further tests and investigations. It is believed, however, that a discussion of the essential features will tend to clear up a few of the conflicting theories of design and, furthermore, that such a discussion will suggest the adoption of certain modifications and improvements which will result in more economical designs.

In the differences in design of highway and street pavements, it is interesting to note that the design of highway pavements has heretofore been largely influenced by the early design of street pavements; whereas the design of street pavements is now largely influenced by the design of highway pavements. As a matter of fact, there are fundamental differences in the requirements of brick pavements constructed on highways and on city streets. The drainage conditions are not the same; the subgrade conditions, both before and after construction, are different; the widths are different, and necessarily the distribution of the weight of traffic is different.

Full recognition of the value of "positive" treatment of the subgrade is vitally important, and recent tests as well as past experience all serve to emphasize this fact. With a subgrade maintained at maximum stability through proper surface drainage and other necessary treatment, the foundation supporting the brick wearing surface may be substantially reduced in cost. The "flexible" type of foundation, composed of gravel, rolled stone, macadam, "black base," or other similar materials, will be particularly suitable and economical in transmitting loads from the brick wearing surface to a subgrade of the character contemplated above. On the other hand, where it is not possible to so maintain the subgrade at its maximum stability at a reasonable cost, as, for example, where numerous excavations have been or may be made in the roadway under the pavement, it will be found that a reinforced concrete foundation will often prove the most economical.

The demonstrated toughness and durability of existing brick wearing surfaces is conclusive evidence that brick of somewhat less depth are the most economical to be used under present and probable future traffic requirements. This is true both on new and on resurfacing projects.

Recent Research Data

Researches on the structural design of highways as conducted by the United States Bureau of Public Roads at the Experimental Farm in Arlington, Va., by the Columbia Steel Company, together with others at Pittsburg, Calif., and by the State of Illinois on the Bates Experimental Road at Bates, Ill., have developed data of far-reaching importance in the field of pavement design and construction. In addition to the researches and tests conducted by the above-named organizations, there have been and are being conducted numerous investigations by various other agencies, all of them contributing to the rapidly growing fund of knowledge concerning the structural features involved in the economical design of highway and street pavements. These tests and researches relate to the subgrade, and the numerous conditions and factors affecting its stability; they relate to pavement foundations, their strength as beams, their ability to withstand impact, and the various materials suitable therefor; they relate to cushions and fillers; to wearing surfaces of different types; they relate to the strength and economy of pavement structures as a whole, and yet, with all this vast fund of new knowledge from recent experimentation, together with the previous information in this field, we find that there are problems involved in the structural design of pavements regarding which there are comparatively little definite data.

Because of this vast and overwhelming fund of new data confronting us we have allowed ourselves to be confused at times in its application to our present highway and street pavement problems. As an example, reference is made to a section of brick pavement tested on the Bates Road. This particular section was known as No. 2, and consisted of 4-inch brick with bituminous filler, a 2-inch sand cushion, and a 4-inch macadam base. Appar-

ently, this section was considered an early failure, and yet upon analysis it is found that no marginal curbing, thickened edges, gravel shoulders, nor any other proper and necessary side support had been provided to prevent lateral displacement of the subgrade and the superimposed materials. As a very natural result, failure was reported, although, as a matter of fact, years of practical highway construction have demonstrated that such a section, with proper side support, provides a pavement of far greater strength than indicated by these tests.

While recognizing the importance of research data in developing modifications and improvements in the design of brick pavements, it is also very essential to bear in mind that the characteristics of existing brick pavements of known strength and merit are the surest guide to economy in design, and are not to be ignored.

Differences in Design of Highway and Street Pavements

In the design of brick pavements, both for highways and streets, the peculiar local subgrade conditions, the prices of materials, the weight and character of traffic, and the width and location of the proposed pavement sections, and many other factors, should be carefully considered. In this connection, it may be assumed that there will be few if any excavations in the subgrade of a highway pavement, whereas in the subgrade of a city pavement such excavations may cover 5 to 15 per cent of the subgrade area, thus requiring very different subgrade and foundation provisions. Theoretically, sewer, water-main, and other trenches can be thoroughly compacted before the construction of a pavement foundation; however, safe foundation design requires some provision for such street conditions other than would be provided for a highway pavement foundation.

Again, the edge of a highway pavement should be designed to support and distribute the weight of traffic under conditions far more severe than those imposed upon the outside edge of a street pavement. In the first place, under present construction methods, the subgrade under the edge of a highway pavement slab is far more likely to be highly saturated with moisture at certain seasons of the year than the subgrade under the edge of a street pavement. And in the second place, whereas the subgrade under the edge of a highway pavement section may be easily displaced laterally, when saturated, the subgrade under the edge of a street pavement is confined by a curbing extending both above and below the pavement. This curbing, with the earth back of it, serves as a buttress to resist the tendency of the subgrade to be displaced laterally.

Essential Features

In considering the economical design of a brick pavement to meet the rigid requirements of present and future traffic, it is important that we apply not only all new data which have been made available through recent research work, but also that we fully recognize and apply those principles of pavement design that have been demonstrated in actual construction during past years. Accordingly, in this discussion the author emphasizes certain features which are considered to be of fundamental importance in the development of an economical design, these features being briefly described as follows: (1) recent research data; (2) differences in design of highway and street pavements; (3) economy of subgrade treatment; (4) relation of subgrade and foundation; (5) thin brick wearing surface; (6) resurfacing with thin brick.

The importance of this lateral force has been referred to but little in discussing the structural design of a brick pavement; however, data collected by the United States Department of Agriculture concerning this force are of great value, and should be more generally applied in designing brick pavement sections. On the brick roads of Florida, as laid on "confined sand subgrades," the report by C. A. Hogentogler, Highway Engineer of the United States Bureau of Public Roads, states that "inadequate side support was the cause of major defects." The effect of the lateral force tending to displace the subgrade and also to displace certain types of foundations was very clearly demonstrated on the Bates Road. A view of Section 7 of the Bates Road, as shown in Bulletin Number 4, June 17, 1922, very clearly indicates a lateral displacement of the foundation, and the positive need of side support. Again, it may be observed that the earth or gravel shoulders along a highway pavement are often rutted and consequently disposed to collect water, and particularly is this water liable to pass under the edge of a highway pavement, whereas, it would not so readily collect under the edge of a street pavement, constructed and used as it is, under altogether different conditions.

Economy of Subgrade Treatment

Considering the magnitude of our highway and street construction program, and the vast

sums of money to be spent in construction and maintenance, it may be safely stated that the greatest field for economy lies in the development of a subgrade which will maintain its maximum stability throughout all seasons of the year.

In the design of a brick pavement, there are two schools of thought: one holding to the theory that most subgrades are treacherous, and therefore should be covered over with a foundation of sufficient thickness and strength to properly support the wearing surface and to receive and distribute the weight and impact of traffic; the other holding to the theory that the pavement proper is essentially a wearing surface or plate, that the subgrade should maintain contact with this wearing surface, and that the subgrade should receive and distribute the weight and impact of traffic as transmitted to it through the wearing surface. In this connection it may be observed that good practice in both highway and street construction requires the removal of surface water by a system of open ditches, by tile drains, or by other proper means. Also good practice requires the exclusion of water from the subgrade structure, and the removal and treatment of "soft" or "spongy" places in the subgrade. While it is true that ample provision is in general made for the removal of surface water, it is also true that underdrainage is too frequently entirely neglected or but partially accomplished.

In discussing subgrade treatment, it is fully recognized that a stable subsoil affords a greater measure of support to the wearing plate, or to the pavement proper, than an unstable one. It is readily apparent that well-drained subgrades make possible the more economical construction of artificial foundations, and also permit a choice of foundations from a greater variety of materials.

If a road is to be built in a location where poor subgrade materials exist, will it be more economical to treat and improve the bearing value of the subgrade materials, or will it be more economical to design a pavement foundation of sufficient thickness and strength to safely distribute the weight of traffic over the poor subgrade? From tests by the United States Bureau of Public Roads, it would seem that it is possible to create over a bad subgrade a layer which has high bearing value, low moisture absorption, and low volumetric change, by the expedient of mixing and harrowing into the soil admixtures such as lime, portland cement, or sand, or by the use of a porous, granular layer. Under just what conditions it is economical to use such a layer, created either by admixing with the subgrade or by placing on top of the subgrade, is yet to be demonstrated.

Very interesting and valuable tests have been made as to the effect of impervious cut-off walls built along the sides of the pavement, in order to reduce the moisture content. Apparently, tile drains and open ditches serve to remove free water, although tests indicate that they do not entirely remove capillary water. The reported tests indicate that impervious cut-off walls built along the sides do not serve particularly well to reduce the moisture content under the slabs. Under these conditions, assuming the removal of free water, and the presence of a high per cent of capillary moisture in the subgrade materials, will it be more economical to reduce the per cent of this capillary moisture in the subgrade by constructing deeper side drains; by building impervious cut-off walls; by mixing and harrowing into the soil admixtures such as lime, portland cement, sand, etc.; or, on the other hand, will it be more economical to construct a foundation of sufficient strength to overcome such subgrade defects?

Connected, of course, with all these questions is the relation of the subgrade to the slab, investigations concerning which have been carried on at Pittsburg, Bates, Arlington, and elsewhere. The report of the National Research Council under date of May, 1923, contains the following interesting statement: "If it is true that a soil of low moisture content offers better support than one of higher per cent of moisture, methods must first be evolved by which moisture content can be stabilized. After these methods have been perfected, their cost must be compared with that of additional thickness of the road necessary to overcome the faults of the subgrade without treatment, to determine whether, economically, it is advisable to treat the subgrade or increase the strength of the slab."

Again referring to examples of successful construction as demonstrated in the past, it may be of interest to recall the fundamental principle of road construction as MacAdam, one of our early road builders, stated it: "That it is the native soil which really supports the weight of traffic; that while it is preserved in a dry state, it will carry any weight without sinking, and that it does in fact carry the road and carriages also; that this native soil must be previously made quite dry and a covering impenetrable to rain must then be placed over it in that dry state; that the thickness of the road should only be regulated by the quantity of material necessary to form such impervious covering and never by any reference to its own power of carrying weight."

Careful analysis will demonstrate that his theory was, and is, sound, although under present-day traffic conditions it will probably be necessary to take additional precautions to preserve the subgrade in the desired dry state.

While it is fully recognized that peculiar local conditions will greatly affect the design of a brick pavement structure, in general it will be found that economical construction can be accomplished only when full realization is had that the function of the subgrade is to carry the weight and impact of traffic, as imparted to it through the superimposed wearing surface; and particularly is this true on highway construction. It is proposed in the following discussion to further emphasize the fact that it is both entirely feasible and economical to design a brick pavement foundation on the basis of this theory.

Relation of Subgrade and Foundation

Present traffic requirements need not necessarily increase the cost of brick pavement foundations, for, by a proper appreciation of present knowledge with regard to existing foundations, together with a rational application of all new data relating to the structural design of pavements, such cost of the foundations may, in many cases, be reduced. In order to design a brick pavement foundation to better meet the requirements of present and probable future highway traffic, and at the same time design one which will be economical in cost, the following features should be given full consideration:

(1) Removal of surface and ground water by the construction of proper side ditches or tile drains.

(2) Reduction of the per cent of capillary moisture by the construction of side ditches or tile drains of the required depth.

(3) Construction of impervious cut-off walls under the edges of the pavement slab, where justified by the cost, (a) to prevent the free passage of surface water and capillary moisture from the roadway shoulders to the subgrade, above the level of the side drains; (b) to create a confined subgrade; (c) to prevent lateral displacement of the subgrade; (d) to maintain the level of the water-table under the pavement; and, finally, (e) to create and maintain a more stable subgrade.

(4) Construction of foundation with thickened edges.

(5) The use of such materials in the foundation as local conditions and prices indicate to be most economical; the thickness of such foundation to depend upon the degree of stability which experience has demonstrated can be safely maintained in the subgrade.

(6) Flexibility in the foundation.

(7) The cost of the foundation proper is dependent upon the degree of stability of the subgrade materials, and, accordingly, any proper investment in the treatment and improvement of the subgrade should be more than offset by the saving thus effected in the cost of the foundation.

Thin Brick Wearing Surface

It is quite interesting that both experience and experiments confirm past conclusions as to the toughness and durability of brick where laid as a wearing surface in a pavement. The fact must be recognized that the virtues of our older brick pavements have been due to the wearing qualities and toughness of the brick surface, rather than to any special virtues in the other component parts of the pavement, such as the foundation, filler, or cushion. This very important truth has been demonstrated in numerous instances, for, despite the character of the foundations, the thickness of cushion, the type of filler, or the lack of maintenance, brick pavements, as a general rule, have demonstrated their value throughout the period of their general use.

The use of a sand cushion under a brick wearing surface is primarily to serve as a bedding course; and, considering its low cost and satisfactory service, experience indicates the desirability of its continued use. In specifying such a sand cushion, best results will be secured by requiring the foundation to be floated, if of concrete, and by spreading the cushion to a uniform depth of one inch, certainly not to any greater depth.

In regard to the type of filler for use in filling the joints between the individual brick of the wearing surface, both experience and recent tests confirm the wisdom of present-day practice in the use of an asphalt filler. So many defects occur where other fillers are used, and so many advantages have been demonstrated in the use of an asphalt filler, that good engineering suggests its adoption as standard construction.

With our present high standards of construction, and with our mechanical methods of securing a uniform and proper depth of cushion, it is entirely feasible to use a brick of less than present depth in the wearing surface, and yet at the same time to provide the essential qualities of durability and toughness which would be secured by using a brick of somewhat greater depth.

It is interesting to recall that one of the

very earliest brick pavements constructed in the United States was built in Charleston, W. Va., in 1873, "hard-burned building brick" being used in the wearing surface; also that the first brick pavement constructed in Peoria, Ill., was built in 1885, the material of the wearing surface being simply "hard, specially selected local building brick." Apparently, since those building brick provided a depth of 4 inches in the wearing surfaces of our early brick pavements, many authorities refuse to recognize any depth less than 4 inches as being sufficient to provide the necessary qualities required in such wearing surfaces. Regardless of the changed character of the foundation, regardless of the improved cushion provisions, regardless of the improved wearing and waterproof qualities of the filler, and regardless of the better wearing qualities of the individual brick itself, there is still hesitation on the part of some authorities to recognize the fact that true economy in brick pavement construction can be accomplished only when full recognition is given the changed characteristics of these various component parts of the whole pavement structure. On the other hand, many other authorities in this matter have recognized the true facts, and not only have they recognized them, but, moreover, they have profited by them in that they have designed and constructed successful brick pavements having wearing surfaces of substantially less depth than originally provided.

Without attempting to discuss in detail the merits of vertical fiber, repressed, lug, or lugless brick, it is suggested that the adoption of the vertical fiber, lugless type of brick as a standard appears to be fully justified by past experience.

Recent investigations point to the interesting conclusion that there is now a strong tendency to specify brick of 2½- and 3-inch depths, in preference to brick of 3½- and 4-inch depths. In fact, a very substantial yardage of paving brick of only 2¼-inch depth is now being used in the wearing surfaces of brick pavements, although in general there seems to be a preference for the 2½-inch brick. Experience has demonstrated that a 3-ton roller will have highly satisfactory results in the rolling of brick of 2½- and 3-inch depths.

The use of brick which provide a less depth of wearing surface than originally specified has greatly increased during very recent years, for not only are such brick widely used in the South and Southwest, but they are also now being manufactured and sold in Ohio, Illinois and other northern states. The question of the durabliity of 2½- and 3-inch paving brick has been conclusively demonstrated in many cases by their satisfactory use over a period of many years.

Considering all the above-mentioned facts, it is recommended that a paving brick having a depth of 2½ inches be adopted as standard for all traffic except the very heaviest, and that for this latter class of traffic a depth of 3 inches be adopted as standard. Both tests and experience confirm the desirability of this change from present standards; and in view of the further advantages to be derived in the matter of repair and maintenance, and in particular in the matter of the resurfacing of old pavements of various types, it is quite certain that the general use of a 2½-inch paving brick is demanded under existing conditions and requirements.

Resurfacing with Thin Brick

As stated above, the resurfacing of old pavements of various types offers a wide field for the use of a 2½-inch brick. With the immense pavement yardage laid in past years and with the rapidly increasing yardage of new construction, it may be readily understood that this vast resurfacing program is worthy of more than passing notice. Economy in such work is essential, probably more so than in original construction, and yet at the same time such resurfacing work should be of a character to meet the ever-increasing requirements of modern traffic.

A thin paving brick lends itself readily to this work, in that it can be laid with minimum inconvenience to traffic, both in the original resurfacing project, and later on, in making necessary repairs. It is very durable, reasonable in cost, and can be laid with minimum change of existing grades.

In considering the character of cushion for resurfacing work, it should be borne in mind that a uniform depth of such cushion is very desirable, and that in general a sand cushion will prove the most feasible and economical; however, it should also be remembered that any substantial inequalities in the surface of the existing pavement structure will require treatment before the spreading of the cushion proper. A variety of materials may be used for this purpose. Such materials should properly be inexpensive in cost, as they are not intended to serve the same purposes as the materials in the original pavement; in fact, their main function is to serve as a filler. Accordingly, concrete may be used, or a mastic composition consisting of 1 part Tarvia "B," or cut-back asphalt, to 10 parts of sand, depending upon the nature of the depressions and inequalities. Such depressions should be leveled up, ready for the spreading of the

sand cushion, for an expense of approximately 20 cents per inch of depth, per square yard of pavement. The cost of a mastic filler for purposes of leveling up the old pavement surface, together with its flexibility, makes it a very desirable material to be used in resurfacing old gravel, macadam, concrete, brick or other pavement types.

Where existing pavements of various types have reached and passed their economic life, they may very properly and economically serve as a foundation for a wearing surface of 2½-inch paving brick. Considering the stability and general value of old pavements where used for such foundation purposes, it is probably an indictment of the engineering profession that it so often permits the entire disturbance and removal of such old pavements, and the construction of new pavements at costs greatly in excess of the proper costs of substantial resurfacing work.

Conclusion

In concluding this discussion, it is desired to emphasize the fact that certain modifications and improvements in the design of brick pavements are entirely feasible, and, moreover, that they are required as matters of true economy in the construction of such pavements. Considering the inherent qualities of toughness and durability, as evidenced in the individual paving brick, and its general adaptability as one of the component parts of an economical type of pavement, it is entirely reasonable to assume that there is a constantly widening field for its use, provided the brick pavement structure as a whole is properly designed.

In summarizing the points discussed, further emphasis should be placed on the following:

(1) Research data are vitally important in the development of an economical brick pavement design, but their greatest value is possible only when they are carefully considered in the full light of successful construction in the past.

(2) There are fundamental differences in the design of highway and street pavements, particularly of the brick type, and only by careful analysis of the peculiar local conditions and requirements can true economy in design be accomplished.

(3) The stability of the subgrade affects not only the design of the foundation, but also the brick pavement as a whole, and, accordingly, subgrade treatment is one of the first and most important considerations.

In general, on highway construction, a stable subgrade will be most economically secured and maintained by the construction of side drains to proper depths, and by the construction of impervious cut-off walls under the edges of the pavement slab. The end sought is to improve the subgrade to a degree of stability where it functions to carry the weight of traffic and the superimposed wearing plate.

(4) The nature, character and thickness of the foundation of a brick pavement should properly depend upon the stability of the subgrade. Stability of the subgrade is secured by reducing the per cent of moisture, and this stability is maintained by preventing the free passage of water and capillary moisture from the road shoulders to the subgrade. The prevention of lateral displacement of subgrade materials, and, at times, of foundation materials, requires the foundation to be thickened under the slab edges, and also requires positive confinement of the subgrade materials by the construction of impervious cut-off walls under the slab edges. It is not only desirable to treat the subgrade, but it is equally desirable to protect it, after once having given it such treatment.

Local subgrade conditions, prices and character of traffic should properly govern the design of the foundation, and the desirability of using cut-off walls, reinforcement, or both. In general, flexibility in the foundation permits the best development of the supporting power of the subgrade.

(5) The adoption of a standard size and type of paving brick, having a depth of 2½ inches, is justified by the demonstrated toughness and durability of brick of this particular depth where used in existing brick pavements. Such a brick may properly be used on all except the heaviest traffic streets, and on such streets a 3-inch brick should be used.

(6) The use of 2½-inch brick in resurfacing work offers a big field for economy in the maintenance and reconstruction of pavements of various types which have reached and passed their economic life.

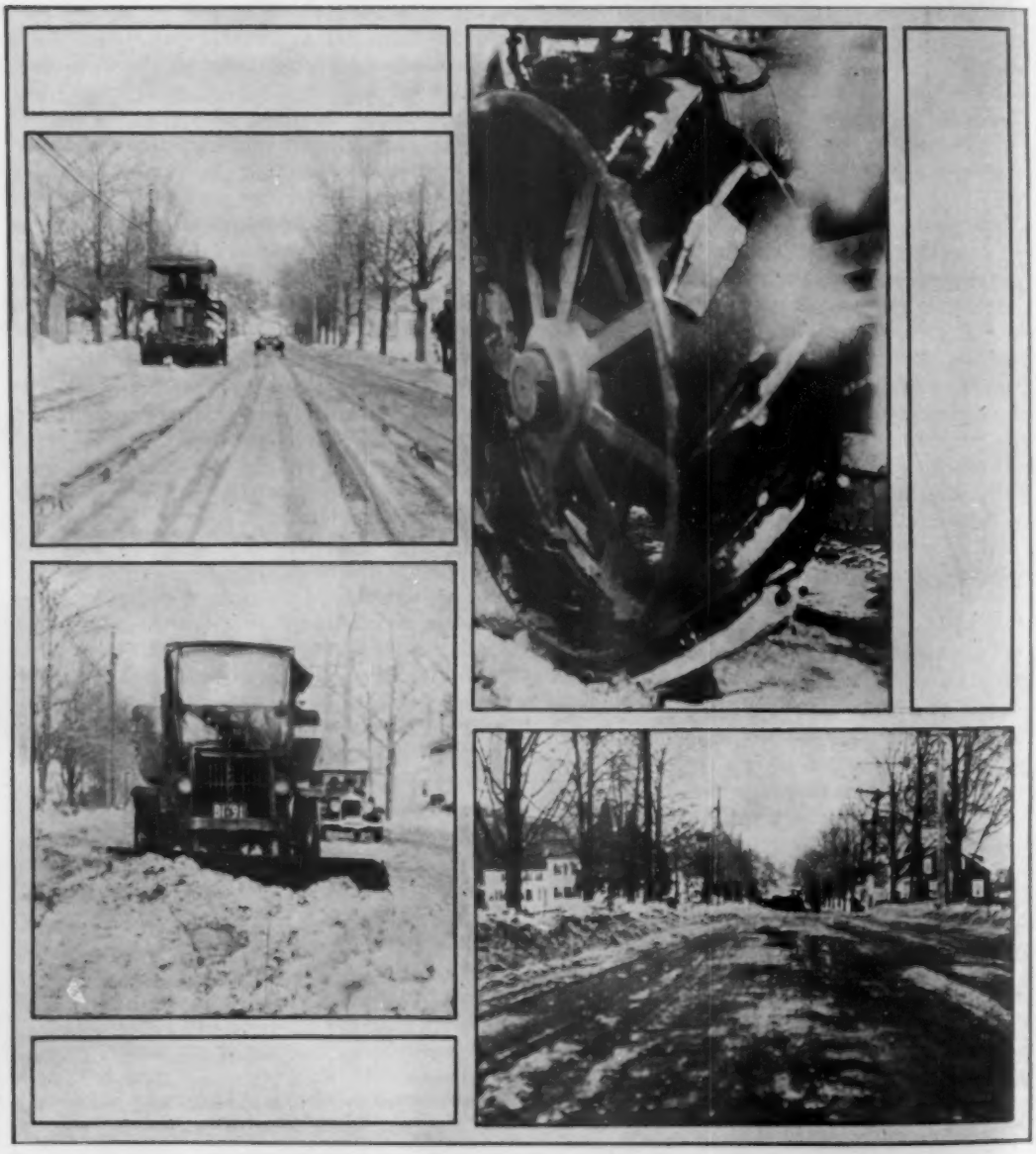
In final conclusion, it is desired to emphasize again the fact that a full development of the supporting power of the subgrade, together with a full utilization of the inherent qualities of toughness and durability in the brick wearing surface, will effect substantial economies in the cost of constructing brick pavements.

ACKNOWLEDGMENT.—From a paper read before the American Road Builders' Association, January, 1925.

Breaking Up Ruts in Icy Roads

Road Roller with Cleats and Blade Plow Effectively Removes Ice

MANY cities throughout northwestern United States experienced a great deal of difficulty in the storms during the first part of February when a rather deep snowfall was followed immediately by rain and then a cold snap. Automotive traffic equipped with chains soon wore ruts in the ice and threatened considerable damage to the roads. George C. Brehm, City Engineer and Director, Department of Public Works, Waltham, Mass., reports that following one of the storms of the first week of February they had about six inches of snow, which turned to rain and then froze. This left some of the roads in a very rutty condition and made them almost impassable.



METHOD OF BREAKING UP RUTTED ICE ON ROADS IN WALTHAM, MASS.
Upper left—Ruts in icy road. Upper right—Cleats on road roller breaking ice. Lower left—Baker snow-plow pushing ice to the side. Lower right—Road practically cleared of ice

To protect the roads and make it possible for traffic to move more readily, it was decided to use a road roller to break up the ice ruts. The cleats on the rear wheels are b-inch angle-irons and, to keep the roller from sliding, 2½-inch T-irons were bent around the front wheels. The results were more than had been expected. Following this, a Baker snow-plow was used to push the cakes of ice broken by the roller.

Methods and Costs of Cleaning Streets in Rockford, Illinois

By B. C. Harvey
City Engineer, Rockford, Ill.

THE city of Rockford is situated in the northern part of Illinois in the Rock River Valley. The area of the city is 7104.74 acres, of which 6912.74 acres are land and 192 acres are creeks and Rock River. The population of the city is 78,000. There are 213,-66 miles of streets, of which 122.34 miles are improved and 91.32 miles are unimproved. The improved streets are composed of the following types of pavement:

	Miles	Square Yards
Sheet asphalt	1.85	50,273
Warrenite-Bitulithic	4.81	78,287
Vitrified brick	19.80	353,687
Reinforced concrete	17.32	335,752
Plain concrete	.06	1,090
Bituminous macadam	19.33	336,281
Water-bound macadam	59.17	1,092,457
Totals	122.34	2,247,827

Street-Cleaning Equipment

The city owns and operates for street-cleaning purposes two motor-driven Elgin pick-up sweepers, two 1-ton Ford trucks with Warford transmission, one South Bend flusher equipped with a Buda motor and pump with a 1,500-gallon capacity tank mounted on a 5-ton GMC truck.

The Street Cleaning Department is composed of the Superintendent of Streets, who supervises the work, two operators for the Elgin pick-up sweepers, one operator for the motor-driven flusher, one operator (night man) for operating the Elgin pick-up sweeper and street flusher, two operators for Ford trucks, and two laborers, one with each Ford truck.

The pavement of the business district covers an area of 190,593 square yards, which is cleaned every night, except Sunday night, by alternating sweeping and flushing; that is, the pavements are swept one night and flushed the next night. It has been found possible to minimize the amount of dirt carried into the sewers and also to eliminate having men follow the flusher and clean gutters. During the daytime, three white wings are employed in the business district to clean in places that are inaccessible to the sweeper and also to pick up loose papers and rubbish that may be strewn during the day.

The secondary town district, together with the main thoroughfares, is swept two or three times each week, the condition of the streets governing the frequency. The residential streets, which are paved with concrete or Warrenite pavement, are swept once each week. The flushing of the streets is supervised, so as to alternate the sweeping and the flushing of all streets.

Sweeping Macadam Streets

The macadam streets are also swept with the motor pick-up sweeper. The bituminous macadam streets are swept as often as the permanently paved streets. The water-bound macadam streets have all been oiled or surface-treated with either asphalt or Tarvia B and are swept three times a year, with the exception of those that are through streets or thoroughfares, which are swept about once every week. Every year the street repair department oils several miles of old water-bound macadam streets, which helps in the cleaning of these roadways.

The life of the fiber broom and gutter broom of the pick-up sweeper is very low while cleaning these streets, because of the roughness of the pavement and the excessive crown. Most of the old water-bound macadam streets are 30 and 34 feet in width, with a crown varying from 14 to 18 inches, with a slope from the quarter-point of the street to the gutter varying from 11 to 14 inches.

During 1924, 1,106,522 square yards of water-bound macadam streets were cleaned prior to oiling or surface coating. The two truck operators and the two laborers are required to pick up and haul to the dump all rub-

bish collected and also to clean such places as are inaccessible to the sweepers. The truck operators help load the trucks.

Method of Keeping Accurate Costs

Each and every man in the Street Department must fill out what is known as an individual time card, which is countersigned by the Superintendent of Streets. On this card appear the man's name, the kind of work, the location of the work, the number of hours worked, the number of loads hauled, and the capacity of the loads.

The sweeper operators mark on their cards the name of each street swept, from and to a certain place, whether the street was swept full width or the number of laps on each side, the number of tanks of water used (this being such a small cost it is charged against flushing), the number of hours the sweepers operate, and the date that every new broom is placed. The truck drivers' and laborers' cards record the name of each man, the kind of work, the number of loads of material picked up and hauled to the dump, the capacity of each load, and the number of hours worked.

The flusher operator marks on his card the name of each street flushed, from and to a certain place, the number of tank-loads of water used, the location of hydrants, and the number of hours that the flusher operates.

The yard foreman keeps records of all oil, grease and gasoline consumed daily by every piece of equipment owned and operated by the Street Department. The record card for this is known as the gasoline and oil card. All of the equipment of the Street Department is under the supervision of a master mechanic whose duty it is to inspect and repair all equipment, the operator of each piece of equipment assisting with the repairing of his machine. Thus, the daily individual time cards of the master mechanic and operator of each piece of equipment show the cost of labor for repairs. All equipment is thoroughly washed, oiled, cleaned and greased once every week, this time being charged against repairs, as it adds materially to the life of the equipment. All bills for repair parts are countersigned and charged to the respective equipment by the master mechanic. All daily individual time cards are handed into the main office, this being the office of the Engineering Department of the Street Department and Sewer Department, before nine o'clock the following morning. The cards are then checked and the time and kind of work executed by each individual are placed on a large card, known as the daily time card. On the reverse side of this card are placed totals, showing cost of labor for repairs of all equipment for the day, as well as totals showing the cost of labor for every kind of work.

These totals are then transferred to a Kardex file, which has a card with one line for each day in the year, with columns for gas, oil, labor and parts. These figures are totaled each month, and the total cost of labor must balance with the amount of the pay-roll for the month, and the oil and gas must balance with the total shown on the oil and gasoline card for the month.

The yardage of streets flushed and swept is also tabulated on a daily cost sheet, one for the flusher and one for each sweeper. These cost sheets show the exact number of square yards of street flushed or swept daily, the number of miles of streets flushed or swept, the amounts of gas, oil and grease consumed by each piece of equipment, the number of gallons of water used by the flusher, the cost of truck service for disposal of sweepings, the cost of labor for the truck operator and laborer, the cost of the flusher or sweeper operator, and the cost of any repair parts purchased, together with the cost of labor for repairing. The Street Department pays the Water Department 7 cents per 100 cubic feet of water consumed. One tank is assumed to contain 200 cubic feet of water. As soon as a new fiber broom or gutter broom is placed on the sweeper, the cost of each broom which was replaced is reduced to a daily cost, which is then placed on the daily cost sheet. On this cost sheet is marked the daily cost per square yard.

Tabulating Costs

On the first day of each month all daily cost sheets for the previous month are tabulated on a monthly cost sheet. On the monthly cost sheet for sweeping are entered the date, number of hours, cost of gasoline, cost of oil and grease, gutter brooms, fiber brooms, operators, repairs, truck service, labor, depreciation, total cost per day, number of square yards cleaned, cost per square yard, number of cubic yards picked up, cost per cubic yard, and number of miles cleaned. The depreciation of the sweepers is computed as follows: The cost of one sweeper is $6,500, the life of a sweeper being assumed to be six seasons (which is very conservative, as all indications point to the sweeper's lasting seven or eight seasons). The six seasons constitute a period of 1,170 working days, which resolves itself

into a cost of $4.44 per day.

Interest at 5 per cent for first year on original investment of $6,500	$325.00
Interest at 5 per cent for second year after deducting the first year depreciation. This depreciation is $1,083 every year. investment being $5,417	270.85
Interest at 5 per cent for third year, investment being $4,330	216.70
Interest at 5 per cent for fourth year, investment being $3,251	162.55
Interest at 5 per cent for fifth year, investment being $2,168	108.40
Interest at 5 per cent for sixth year, investment being $1,085	54.25
	$1,137.75

This total interest charge of $1,137.75 for a period of 1,170 days makes a total of 97 cents per day. The depreciation charge against the machine is figured at $6.50 per day.

On the monthly cost sheets for flushing are entered the following items: date, hours, cost of gasoline, cost of oil and grease, operators, water, repairs, depreciations, total cost, number of square yards flushed, cost per square yard, and miles flushed.

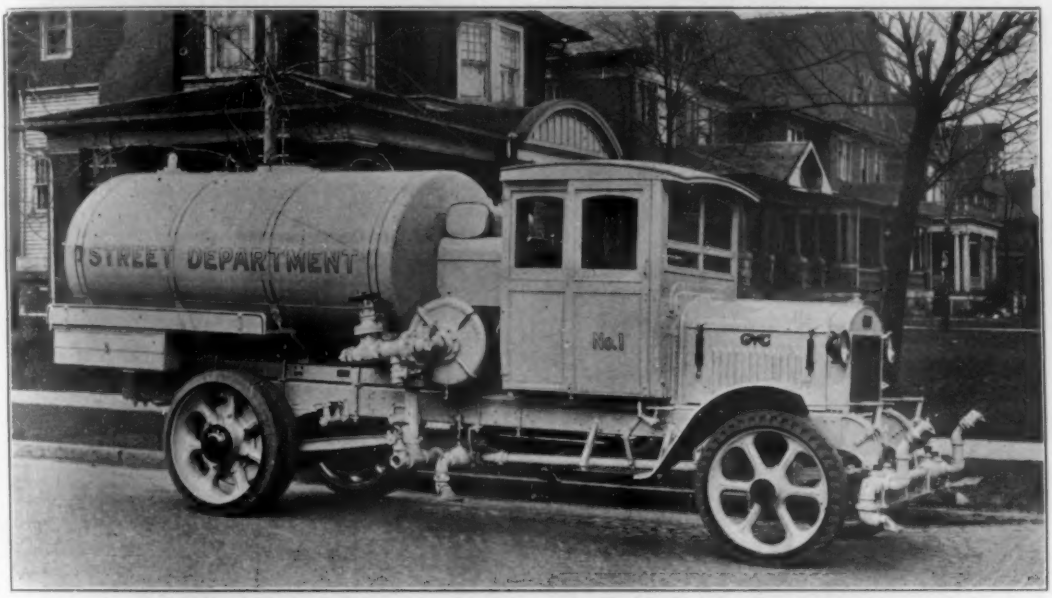
The depreciation of the flusher is computed as follows: The cost of the flusher is $6,688.25. The life of the flusher is assumed as 10 seasons, constituting a period of 1,950 working days, which resolves itself into a cost of $3.43 per day:

Interest at 5 per cent for first year on original investment of $6,688.25	$334.41
Interest at 5 per cent for second year, after deducting the first year depreciation, investment being $6,019.43	300.97
Interest at 5 per cent for third year, investment being $5,350.61	267.53
Interest at 5 per cent for fourth year, investment being $4,681.70	234.09
Interest at 5 per cent for fifth year, investment being $4,012.97	200.65
Interest at 5 per cent for sixth year, investment being $3,344.15	167.21
Interest at 5 per cent for seventh year, investment being $2,675.33	133.77
Interest at 5 per cent for eighth year, investment being $2,006.51	100.33
Interest at 5 per cent for ninth year, investment being $1,337.69	66.88
Interest at 5 per cent for tenth year, investment being $668.87	33.44
	$1,839.28

The total interest charge on the flusher being $1,839.28 for a period of 1,950 days, gives a per diem charge of 94.3 cents. A depreciation charge of $4.40 per 8-hour day is charged against the flusher.

Street Sweeping Costs for 1924

During 1924 the two motor-driven pick-up sweepers operated a total of 3,102.5 hours, using 4,323 gallons of gasoline at a cost of $697.81, 1,557 pints of oil at a total cost, with grease, of $186.72. The total cost of gutter brooms was $620.25, fiber brooms $974.94, cost of operators $2,200.02, cost of repairs $1,622.90, total cost of truck service for picking up sweepings $2,113.05, cost of labor for operating truck and picking up sweepings $2,670.96, depreciation for the year $2,268.75, total cost for operation $13,355.40. For this sum, 32,197,094 square yards were cleaned, from which 7,499 cubic yards of material was picked up. The average cost per 1,000 square yards cleaned was 41.4 cents, and the average cost per cubic yard of material picked up, including sweeping, was $1.78.



SOUTH BEND FLUSHER IN ROCKFORD, ILL., MOUNTED ON GMC TRUCK

Does It Pay to Have Motor-driven Equipment?

In answer to this question, one has only to analyze the foregoing figures. The cost of operating the sweeper is $4.304 per hour and, assuming common labor at 55 cents per hour, this would mean that 7.83 men could be employed for the same rate of pay per hour as one sweeper. During this one hour these same 7.83 men must sweep 10,377.79 square yards, or each man must sweep 1,325.388 square yards per hour. Now, assuming that one man is pushing a broom 14 inches wide, in order to cover an area of 1,325.388 square yards, this man must push the broom for a distance of 10,230.267 feet, or nearly 2 miles per hour, and at the same time this same man must pick up the sweepings and haul them to the city dump, which is a physical impossibility.

Flushing Costs for 1924

During 1924 the motor flushers operated a total of 1,857.5 hours, using 3,392 gallons of gasoline at a cost of $567.17; 486 pints of oil and grease were used, costing $29.76; 6,356 tanks or 9,534,000 gallons of water were used, costing $889.84. The total cost for the operator was $1,319.49, for repairs $27.93, and total depreciation $1,021.67, making the total cost of operations for 1924, $3,855.86. For this sum, 44,814,014 square yards of street surface were flushed at a cost of 8.6 cents per 1,000 square yards.

Comparison of Costs

During 1920 the city of Rockford spent $30,719.75 for cleaning streets, all the streets being cleaned by the hand broom method and the rubbish hauled to the dumps with teams. The business district was cleaned during the daytime by eleven white wings, and the streets in the residential sections were cleaned semi-annually.

During 1921, $35,724.68 was spent for cleaning streets, the same methods being used as during 1920, except that the through streets or thoroughfares were cleaned once every week.

During 1922 the city spent $13,316.48 for cleaning its streets, one motor-driven Elgin pick-up sweeper being purchased in March, 1922. The sweeper operated 16 hours per day, sweeping the business district from 12 midnight until 8 A. M., and from 8 A. M. to 5 P. M. it operated in the residential districts. The white wings were reduced to three in number and the streets were swept more often than in previous years.

During 1923, $19,331.43 was spent for cleaning the streets. In March, 1923, the second motor-driven pick-up sweeper was purchased, as the 16-hour day was quite a strain on the old sweeper and, had the sweeper broken down, the street cleaning would have been materially handicapped. The yardage of streets cleaned in 1923 was much greater than in 1922, showing that the organization was more efficient.

During 1924, $16,009.00 was spent for cleaning streets. These figures include the removal of snow, but do not include depreciation charges.

Twenty-Four Million Citizens Benefit by Zoning

HEADED by the cities of New York, Chicago, Boston, Baltimore, Pittsburgh and Los Angeles, a total of 320 municipalities throughout the United States, with a total population of more than 24,000,000, had zoning ordinances in effect on January 1, 1925, according to information obtained by the Division of Building and Housing of the Department of Commerce. The municipalities range in population from the city of New York with its millions of inhabitants down to the smallest villages.

Sixty-two municipalities zoned during 1924. Of this number, 28 have a population of less than 10,000 inhabitants; 21 have more than 10,000 and less than 50,000 inhabitants; and 13 have more than 50,000 inhabitants.

Of the total number of zoned municipalities, 199 have zoned comprehensively, regulating the use, height and area of buildings, while 121 do not go quite so far, many regulating only the use of buildings, and some few regulating the use and area or the use and height of buildings.

New Jersey still leads in the number of zoned municipalities, having 72; New York has 56; California, 38; Illinois, 36; Massachusetts, 24; Ohio, 21; Wisconsin, 14; Michigan, 9; Indiana, 5; Kansas, Missouri, Pennsylvania, Rhode Island, and Virginia, 4 each; Florida, Minnesota, Oklahoma, and Washington, 2 each; and Alabama, Arkansas, Colorado, Connecticut, Delaware, District of Columbia, Georgia, Iowa, Maryland, Nebraska, Nevada, North Carolina, North Dakota, Oregon, South Carolina, Tennessee, and Utah, 1 each.

In the many state legislatures now in session, zoning is receiving more than passing attention on account of the wide-spread interest in the subject shown by the public at large. Such legislation has been strengthened materially through the use by state legislators of "A Standard State Zoning Enabling Act" prepared by the Advisory Committee on Zoning of the Department of Commerce to serve as a model for those desiring to introduce zoning legislation in their states. The states that have used the Standard Act in whole or in part since its tentative publication in 1922 are as follows: Colorado, Delaware, Illinois, Iowa, Nevada, New Jersey, North Carolina, North Dakota, Oklahoma, Pennsylvania, Rhode Island, South Carolina, and Wyoming.

The Municipal Index for 1925.

The Governors and the Cities: 1925

By William A. Robinson
Department of Political Science, Dartmouth College

IN Rhode Island, Governor Pothier proposes amendments corrective, in part at least, of the representative situation. The underrepresentation of Providence and other populous urban communities has long been an outstanding abuse in American government, and during the past year produced a collision in the Legislature which caused a vast amount of unfavorable comment on the institutions of one of our oldest states. Governor Pothier's recommendations are distinctly moderate. In the Senate, he says, each town and city should have at least one member, and increased proportionate representation could be secured by increasing the size of that body. For the House, he advises a redistricting of the state, based on voting or citizen population, each town or city being allowed at least one member, none to have more than one-fourth of the total. He also advises abolition of the property qualification for voting within the present and all future cities chartered by the Legislature. In Delaware, Governor Denney urges an amendment giving Wilmington four additional representatives and two senators, pointing out that the Senator from that city now represents 55,000 people as compared with the 6,000 to 8,000 represented by the Senator from the rural districts.

High Points in the Governors' Messages

An examination of the forty governors' messages appearing during the month of January shows some interesting comments on the municipality as a subdivision of the state. There is also a great deal of material of interest to the municipal official merely because of his share in the responsibilities of the state. The governors' discussions on taxation, highways, education, law enforcement, and other problems should receive much more attention than they ordinarily get.

Home Rule for Cities and Counties

In New York, Governor Smith states the benefits already appearing under the home rule amendment of 1923. Legislative amendments to the New York City charter dropped in 1924 to three as compared with thirty-five at the preceding session, and statutes were reduced from seventy-seven to thirty-seven. The new system has lessened the pressure on the Legislature and relieved the cities of considerable interference. The Governor advises earnest consideration of recommendations from the Home Rule Commission which has been studying the application of the new amendment. He likewise recommends more freedom for the counties included in Greater New York, especially in matters of salary and personnel. In Missouri, Governor Baker urges that cities be permitted to select and control their own police officials, "the art and practice of self-government being essential to growth and development." He recommends, however, that the governor be empowered to remove on formal charges, after hearing, any county or city official proved derelict in his duty. A successor in such case should be a member of the same political party as the person removed. In Wisconsin, Governor Blaine advises the completion of the home-rule program already begun for counties, villages and cities.

Expenditures and Indebtedness

It is in the field of finance that most interesting comments are found. Economy is the watchword everywhere in regard to state policies. A great many governors show that, heavy though state taxation may be, the heaviest burden is imposed by counties, municipalities, school districts and other subdivisions. Governor Christianson of Minnesota remarks, however, that the state cannot escape some responsibility. "Every time the salary of a local official is raised, every time a new activity is made mandatory on a community, every time a new form of state aid is held out as a bait, local taxes are being raised just as surely as if the levy for them were made by the Legislature." He advises that legislation affecting the smaller units of government be permissive rather than mandatory. In the matter of bond issues, he urges that none be permitted unless "as an integral and inseparable part thereof, there be an irrevocable tax levy running over the entire period between the creation and maturity of the obligation, to create a sinking fund sufficiently large to discharge the bonds at the expiration of that period."

In Massachusetts, Governor Fuller declares that municipal expenditures and indebtedness constitute a problem of alarming proportions and urges that public opinion receive more enlightenment on the subject. He advises a less liberal law on the subject of municipal borrowing and a reclassification of the cities on the basis of assessed valuation, with a similar classification of borrowing powers. In New Jersey, Governor Silzer comments on the popular tendency to ignore the proceedings of the local authorities until the tax bills come in. Municipal bodies, he declares, are practically free to spend what they like and "we are living in extravagant days." Frankly recognizing that "only a limited number of citizens are willing to lend assistance to tax reduction," he advises the creation of a state board to which citizens could appeal in matters involving expenditure, budget making, or the issuing of bonds. Such a board would, in his opinion, serve as a restraining influence on the local authorities. They would be inclined to fear appeals, and it would also permit the veto of extravagant and unnecessary expenditures.

Governor Donahey of Ohio, however, has a different view as to the rights of localities. "I would give the people of each taxing district full control over future increases in the tax levies, debts, and sources of revenue. Why should they not be permitted to vote their tax rates as high as they want them and issue as many bonds as they desire, so long as they themselves pay the bills they create?" The proper duty of the state, according to his view, is to see that actual majorities govern, and he announces his intention of vetoing any measure giving the local tax-spending officials the right to impose taxes without popular referendum.

While the referendum can hardly be said to have gained prestige in recent years as a law-making instrument, its use in financial matters is growing. Governor Donahey quotes from his own message of 1923 that "the evil of our present and past taxation laws has been that the taxpayers have been at the mercies and caprices of a few public officials and little self-seeking minorities of people"; and he adds, in his 1925 message:

"The foregoing is equally true to-day. I am a firm believer in majority home rule in local taxation, and shall veto, as I did two years ago, any measure giving local tax-spending officials the right to impose additional taxes without submitting the question to popular vote. Such a measure, as you recall, was defeated at a state-wide referendum in November, 1923, by a majority of more than 500,000." Governor Peay of Tennessee comments in his message on the excellent results accomplished in that state by requiring its use on all bond issues of municipalities and counties, and warns that he will use the veto on all permissive enactments where it is omitted. Governor Hartley of Washington makes a similar statement as to its merits, and advises fixing a required total vote in order that approval of expenditures or indebtedness may more accurately express the will of the public.

An Out-of-the-Ordinary City Book

"THE object of this publication is not to relate the achievements under the new form of city government, but to acquaint the people of Norfolk with things concerning their own city that may not be generally known, with what may be regarded as certain evidence that a firm foundation for the development of Metropolitan Norfolk has been laid."

With this announcement on the title page, signed by Albert L. Roper, President of the City Council and Mayor, and W. B. Causey, City Manager, there has been published an unusual brochure entitled "City of Norfolk, Virginia." Well-printed and beautifully illustrated, its 80 pages contain a wealth of information of interest to the citizens of Norfolk and to forward-looking officials of other municipalities. Each of the twenty-four chapter headings begins with the word "How"—the attention-compelling character of these headings being indicated by the following samples:

How Norfolk Turned Over a New Leaf and Simplified Its City Government
How the City Manager and City Council Prepare a Budget
How Norfolk Built a Municipal Grain Elevator and Mammoth Terminal with Potentialities for a Trade Zone
How Norfolk Invested in a $6,000,000 Water-Supply System After Learning What Shortage Means
How Norfolk Transformed Its Police Force
How Norfolk Reorganized Its Fire Fighting Force and Wiped Out Its Demerits for Hazards
How Norfolk Aids the Cause of Popular Education Through Its University for the People, Otherwise Public Libraries
How the Department of Public Works While Engaged in Routine Matters Prepares for Greater Things
How Norfolk's Juvenile and Domestic Relations Court Won Fame
How Norfolk Perfected Its Milk Supply
How Norfolk Invested in Playgrounds and Golf Links

Requests for copies of this Norfolk book should be addressed to the City Manager.

Value of Vital Statistics to Small Towns

By George C. Whipple

Late Professor of Sanitary Engineering, Harvard University

FACTS relating to births, marriages, and deaths are not "statistics" unless they are expressed in figures. In towns so small that the facts themselves can be kept in mind, the need of numerical statement is less than in larger communities, yet even in small towns accurate records of vital statistics are important. Small towns are subdivisions of counties and states, and the accuracy of statistics for the larger units depends upon the care with which the data are recorded for each community, large or small.

Small towns have a habit of growing into large towns, and these in turn become cities. The change is usually gradual. Urban conditions demand new habits, new methods of government and various public utilities. The state of change is a state of danger. Often the citizens do not realize that their little rural village is becoming urban. They cling to their individualism and hesitate to throw themselves into community movements. In small towns it is easy to ascertain accurately the population year by year, and a study of these figures over a period of five, ten, or twenty years shows the drift of the town. It also enables comparisons to be made with other communities.

Many towns do not grow, but remain stationary or decline. Should towns in this condition hesitate to introduce public improvements of one kind or another? Much depends upon the character of the population, especially its age distribution. Some towns remain nearly stationary, but have a fairly normal number of children, middle-aged, and old people, of both sexes; other towns remain small because the active youths have left and the number of persons beyond middle life has become abnormally large. These conditions may be known in a general way, but it is only by the use of statistics that they can be accurately known and their significance appreciated.

Knowledge of the causes of death is just as important in a town as in a city. In spite of isolated residence, opportunities for contact occur through meetings of the people in schools, churches, stores, assembly halls, and neighboring homes, and such diseases as measles, whooping-cough, influenza, and the common cold may become epidemic in rural districts. Data in regard to all communicable diseases are important not only for their value to local physicians but as a contribution to the science of preventive medicine in general.

In using figures relating to deaths and the causes of deaths, it is common to compute death-rates, that is, ratios between the number of deaths per year and the population. In studying such rates for small towns, it is important to recognize the fact that the fluctuations in rate year by year are much greater than for larger places. The following example illustrates this:

General Death-Rate

Year	Yarmouth, Mass. (Population, 1,420)	Springfield, Mass. (Population, 88,926)
1910	21.1	16.7
1911	25.4	15.5
1912	28.9	15.5
1913	16.2	15.1
1914	24.7	15.2

The reason for this is obvious. With a small population the effect of a single unusual death on the annual rate is considerable, while in a large population an unusual number of deaths would be divided by a large denominator and the effect on the death-rate minimized. Because of this tendency to fluctuate, yearly comparisons of death-rates between small towns mean very little and should be made with great caution.

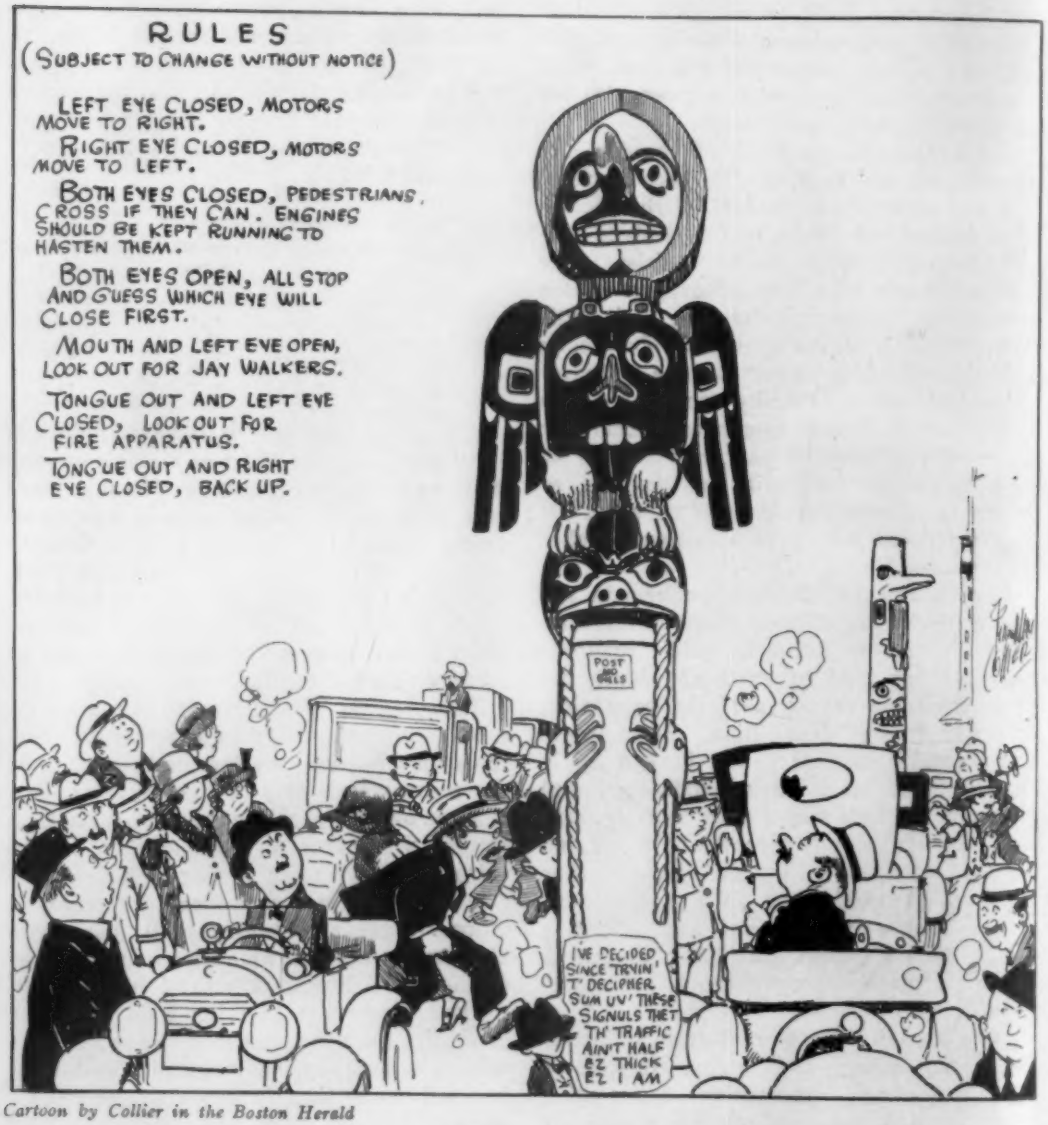
The effect of age distribution on the death-rate is also a matter of importance. A small town may boast of its low death-rate, when the reason for it may be that there are few children and old people in the place, the natural specific death-rates for both of these classes being high. A town having a high death-rate may be accused of having insanitary conditions, whereas by reason of its having an abnormally large number of old persons the death-rate ought naturally to be high.

These facts are mentioned in order to emphasize the point that it is somewhat more difficult to interpret fluctuations in death-rates in small towns than in larger places. Comparisons between small and large places are especially liable to fallacious conclusions. Statistics themselves do not lie, because facts are facts whether expressed in words or in

figures; but logical processes are subject to many fallacies and these are especially difficult to detect when the facts are expressed in figures.

In the old days the family Bible and the tombstone were the chief repository of records of birth and death in small towns. Now government does these things, and it is of great importance to every individual, whether he live in a small town or a large city, to make sure that his own birth has been accurately recorded.

The Totem Traffic Tower


RULES
(SUBJECT TO CHANGE WITHOUT NOTICE)
LEFT EYE CLOSED, MOTORS MOVE TO RIGHT.
RIGHT EYE CLOSED, MOTORS MOVE TO LEFT.
BOTH EYES CLOSED, PEDESTRIANS CROSS IF THEY CAN. ENGINES SHOULD BE KEPT RUNNING TO HASTEN THEM.
BOTH EYES OPEN, ALL STOP AND GUESS WHICH EYE WILL CLOSE FIRST.
MOUTH AND LEFT EYE OPEN, LOOK OUT FOR JAY WALKERS.
TONGUE OUT AND LEFT EYE CLOSED, LOOK OUT FOR FIRE APPARATUS.
TONGUE OUT AND RIGHT EYE CLOSED, BACK UP.
POST NO BILLS
I'VE DECIDED SINCE TRYIN' T' DECIPHER SUM UV' THESE SIGNULS THET TH' TRAFFIC AIN'T HALF EZ THICK EZ I AM

Cartoon by Collier in the Boston Herald

THE EFFECT ON A CARTOONIST'S IMAGINATION OF THE COMPLEXITY AND LACK OF STANDARDIZATION OF TRAFFIC CONTROL DEVICES AND SIGNALS IN CITY STREETS

Forward Steps in City and County

Protection of Grade Crossing on the Erie Railroad by Municipal Policemen

YOUNGSTOWN, OHIO.—In the city of Youngstown the Erie Railroad is unfortunate enough to cross the principal arteries of north-and-south street traffic at grade right at the bottom of a hill. With vehicular traffic increasing each year, accompanied by a corresponding increase in the number of minor accidents and damage cases, it became evident that an improvement must be made in the method of protecting the crossings.

Accordingly, on March 27, 1923, the regular groundmen on the three most important crossings, namely, Wick Avenue, Holmes Street, and Westlakes Crossing, were replaced by men wearing the regulation city uniforms and police badges. These men had been released by the city from its police force on account of reductions made therein. Although carried on the pay-roll of the railroad company, they reported directly to the captain in charge of the city traffic squad. The crossings were thus protected for sixteen hours per day, from 7:00 A. M. until 11:00 P. M., each man working eight hours.

Under this method much better control over vehicular traffic was obtained at first, as all drivers had proper respect for the uniform. However, it soon became known that the uniforms were not backed with full police authority, and their effectiveness began to wane.

Thereupon a request was made of the city that the men placed at these crossings be taken on as part of the regular police force, with full police powers and carried on the city pay-roll, the city to be reimbursed for their wages each month by the railroad company. As a result, in June, 1923, the Youngstown City Council passed an emergency ordinance authorizing the Director of Public Safety to employ patrolmen to be known as "Special Traffic Patrolmen." This ordinance was declared to be an emergency measure and its passage necessary for the protection of the health and safety of the inhabitants of the city of Youngstown, the immediate necessity therefor being the danger to the traveling public caused by lack of traffic patrolmen at railroad crossings in the city. Immediately after the passage of this ordinance the city put regularly appointed policemen in uniforms and with full equipment on the three crossings mentioned.

There has been marked improvement over the old method of handling traffic with the towerman and a flagman on the ground, as then the sound of the towerman's gong preparatory to lowering the gates was a signal for all vehicles to make a dash to get over the crossing ahead of the oncoming train and the lowering of the gates. Now, traffic is handled in the same manner as at busy street intersections. The policemen use their whistles and hands to give signals in the daytime, and a lantern at night. Naturally, drivers have become accustomed to obeying instantaneously signals controlling street traffic and do the same at our crossings. Should a driver recklessly drive over a crossing under the gates while being lowered, or in any way disobey the traffic signals, his license number is taken and he is called into court on a charge of reckless driving.

Our initial success at Youngstown was such that we had for some time been contemplating the possibility of doing away entirely with the operation of the gates and depending solely on the policemen for proper protection. Consequently, when it became necessary for us to remove the gates at our Main Street crossing, Jamestown, N. Y., on account of grade elimination work at that point, we decided to try this plan. At our request, the city of Jamestown furnished regular traffic policemen for duty at this crossing. For the past year these policemen have satisfactorily handled the traffic and protected the crossing without the aid of the crossing gates. Eventually it should be possible to adopt the policy of eliminating gates at all crossings protected by regular traffic policemen.

There has not been a single collision between street and track traffic at any of the Youngstown crossings since the policemen were placed. The record at Jamestown is quite as good, there having been only one injury case, in no way chargeable to inadequate protection.

Any city that wants safe crossings will find this method effective.

R. S. PARSONS,
Vice-President, Erie Railroad Company.

Radio Helps Tree-Planting Campaign

BUFFALO, N. Y.—A method of arousing interest and securing action in tree planting which proved successful last spring in Erie County, New York, may be of interest to organizations desirous of stimulating reforestation during the spring months of 1925.

To begin with, one day early in the year the writer made a trip to Albany and secured the promise of 60,000 trees for Erie County. This substantial assistance in our local efforts was made possible by the fact that the state of New York has adopted a policy of reforestation. The Conservation Commission is operating nurseries where trees are grown by the millions and are sold to private landowners at the very small price of from $2 to $4 per thousand, depending upon the age. Trees are given free for planting on publicly owned land; for example, land owned by cities, counties, towns, villages, etc.

The next step was the designation by Mayor Frank X. Schwab of May 7 as Tree-Planting and Conservation Day. The next problem was to get places to plant all the trees. This was solved by the cooperation of Mark A. Rigg, Jr., of the Federal Telephone & Telegraph Company's radio station, WGR, who gave the writer the privilege of broadcasting over the radio on March 28. For the next month Mr. Rigg mentioned tree planting in his daily talks over the radio, and applications came in from farmers and others for all the available trees. On the morning of May 7 from the Y. M. C. A. Central Branch, in Buffalo, busses and trucks were sent in all directions through the

county's devastated land, and Boy Scouts were assigned to the various sites to help in planting the trees.

The day was ended by a banquet in the evening at the Buffalo Trap and Field Club, with more than 300 persons present, where State Conservation Commissioner Alexander Macdonald, Superintendent of Forests Clifford R. Pettis, and the Mayor and other speakers gave talks on conservation and reforestation.

As a result of New York's policy of reforestation, many forests have been established in the state, sometimes even by country school districts, one of which acquired 100 acres of land, which is being planted by school children at the rate of about 20 acres per year. After 30 or 40 years, the income from this land should be sufficient to support a country school. Many cities in the state have planted trees on the land which they have acquired in connection with their water-supply systems. Some villages have bought land and started municipal forests.

DR. HENRY E. BISCHOF,
Chairman, Reforestation Committee, Erie County Conservation Society.

Street Widening by Bond Issue, Assessment and Donation of Property

NASHVILLE, TENN.—In sponsoring the reconstruction of the important Church Street arterial highway in Nashville, the first section of which has just been completed and opened to the public, the Nashville Exchange Club has accomplished a constructive piece of work.

Less than two years ago this city was attempting to handle the heavy traffic of its business section through only one artery running east and west. The city was growing rapidly, but on account of the limited outlet to the already congested business section it was not expanding in a healthy manner. Early in 1923, the Exchange Club, at the suggestion of its new President, Dr. W. D. Haggard, undertook to work out a solution of this traffic problem. The Club members entered into the plan with enthusiasm, and the necessary committees and workers' organizations were appointed and assigned to their definite tasks.

The first step taken was to secure the city's authorization of a referendum bond issue of $200,000 for widening, repairing and reconditioning Church Street. The up-town section of this street, from Third Avenue to Eighth Avenue, is the principal retail business street of the city. At Eighth Avenue, however, the street formerly dropped down in a steep grade to a viaduct crossing the railroad tracks north of the Union Station, and from the viaduct westward to the street's terminus at Twenty-fifth Avenue, it was too narrow to handle heavy automobile traffic and street cars at the same time. The suggestion made by the Exchange Club was to the effect that Church Street be widened 15 feet from the west end of the viaduct to Twentieth Avenue, and that the grade of the street be raised from the eastern end of the viaduct to Eighth Avenue, so that it might be better fitted for use by heavy traffic.

This plan, when put before the Mayor and Board of Public Works, met with approval, and the necessary measure for submitting the bond issue to the voters was subsequently passed by the City Council. On the day of the election, workers from the Exchange Club were present at every voting booth, and the final count of the ballots showed that the issue had carried by a vote of approximately 25 to 1.

It was soon learned, however, that approximately $60,000 more than the original estimate of $200,000 would be required to carry out the project as planned. But we were able to meet this apparent deficit upon the receipt of $64,000 from the Nashville Railway and Light Company, which sum that Company, in accordance with its franchise provisions, was required to contribute toward the

GOVERNOR AUSTIN PEAY OF TENNESSEE, SPEAKING AT OPENING OF THE NEW APPROACH TO THE EAST END OF THE VIADUCT IN NASHVILLE

cost of raising the grade of Church Street from the viaduct to Eighth Avenue.

As the result of a house-to-house canvass by teams of club members, ninety per cent of the property holders on Church Street west of the viaduct to Twentieth Avenue signed agreements donating to the city 7½ feet of the front of their property to allow for the widening of the street. Fortunately, the majority of the buildings were residences, set back off the street, so that the widening in most cases involved only the cutting-off of front yards. In conducting this canvass, the Club performed what was probably its greatest service in connection with the entire project, for if all this property had been acquired by the city through condemnation proceedings the cost would have reached a tremendous figure.

With the plans so far adopted well under way, the Club decided to take a step farther by urging that the section of Church Street east of the viaduct to Eighth Avenue be widened as well as raised. To secure funds for this additional project, the property holders on each side of the street in this section were assessed for their share of the cost under the front-foot assessment law. In this way about $72,000 was raised, which enabled the city to repave this part of the street and put in curbs, gutters and reinforced sidewalks, in addition to making the proposed widening of 7 feet on each side.

Up to the present time, the street between Eighth Avenue and the viaduct has been widened, raised, repaved and opened to the public. West of the viaduct most of the buildings that had to be set back or cut off have been repaired, and work on the reconditioning of the street has now been started. The widened area will be paved with terra-cotta colored concrete, 6 inches in thickness, and the sidewalks and curbs will be of gray concrete. The present brick paving in the center of the street will not be disturbed.

As a final step in the Church Street development, the Exchange Club is now sponsoring a project for the extension of Ninth Avenue to connect with the Church Street artery, thus providing a through route from many outside sections of the city to the up-town business center. The approval of these plans by the city officials has already been secured.

R. G. FIELDS.

Boy Scouts Help City of Alameda Fight Ants

ALAMEDA, CALIF.—For some years the city of Alameda has had the assistance of the local Boy Scouts organization in an attempt to eradicate the Argentine ant, a pest which is a source of annoyance throughout the whole east bay section. The city expends $250 per year for the purchase of ant poison and containers, and the Boy Scouts distribute this poison throughout the city in a most effective manner. Each boy is given charge of a certain area, and he has the responsibility, under a district captain, for the maintenance of poison in that area until the ants are exterminated, and also for a constant vigilance to prevent their reoccurence.

Studies are made by the Boy Scout organization of the habits of ants, and the location of their nests and feeding places. It was found that the Argentine ant places aphis and mealy bugs on plants and trees, and then carefully encourages

BOY SCOUT ANT FIGHTERS IN ALAMEDA, CALIF.

and protects them from their natural enemies. This interest of the ant in the aphis and mealy bug is due to the fact that he milks these insects, obtaining thereby a sustaining fluid. Birds which are the natural enemy of aphis and mealy bugs are attacked by the ants, who overrun their nests and kill the young birls.

During the last fiscal year 10,000 containers filled with ant poison were placed by the Boy Scouts on street trees and in the yards and gardens of homes; 218 Boy Scouts participated in the ant campaign. Approximately 2,000 homes were treated successfully, each home receiving not less than two treatments of ant poison. A can of poison was placed on every street tree in the city, which was found infested with ants. It was discovered that the eucalyptus tree was the only species that was entirely avoided by the ants.

An organization of Boy Scout ant fighters has been evolved consisting of three grades, each with a distinctive name, and each member of which wears a celluloid button with his grade printed thereon. The boys are promoted from one division to the other as they complete a set series of tasks. Each boy who finally goes through the three grades is decorated in February of each year, by the Mayor of Alameda, with a "Civic Service Medal," a distinction of which the boys are rightfully proud. The three grades are as follows:

Ant Shooters—Scouts who treat ten homes twice and hang cans on one hundred trees;

Ant Trailers—Scouts who keep cans filled in a district of two city blocks for six weeks;

Expert Ant Shooters—Scouts who have charge of ten city blocks and eight boys for three months.

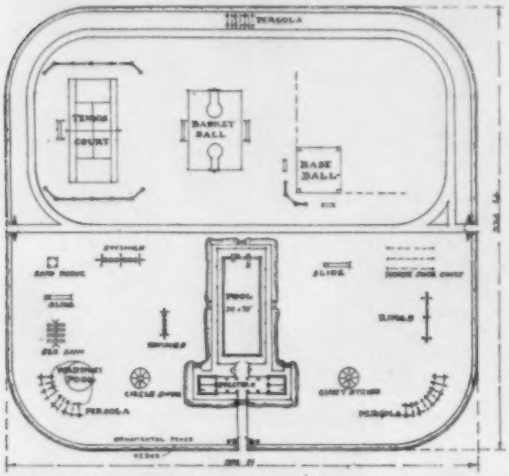
CLIFTON E. HICKOK,
City Manager.

EDITORIAL NOTE.—The reader is referred to page 373, April, 1924, THE AMERICAN CITY, for an article on "The Argentine Ant, a Scourge of Many Cities," by W. Dwight Pierce, Ph. D., Consulting Biologist, Banning, Calif.

Playgrounds in New Real Estate Subdivisions in Houston

HOUSTON, TEX.—Realtors of this city are showing a commendable foresight in setting aside, in new additions, space for play and park purposes.

In the Southside Place subdivision of 110 acres, now being developed, the Grain Ready-Cut House Company is dedicating as a playground an area of 334 x 374 feet—approximately 2½ acres. As shown by the accompanying plan, the equipment



PLAN OF SOUTHSIDE PLACE PLAYGROUND AND PARK
DEVELOPED BY GRAIN READY CUT HOUSE CO HOUSTON TEXAS

will consist of a concrete swimming pool, a running-track, tennis and basket-ball courts, a baseball diamond, swings, etc.

In subdividing this property, the Grain Company agrees with all purchasers that the company, as owner, will maintain the playground at its expense until January 1, 1927, and that at a later date it will deed the playground property to an association composed of property owners in this subdivision. In every purchase of a building site, the purchaser executes a non-interest-bearing note for the sum of $50, which is payable in five annual instalments of $10 each. All funds derived from these payments are to be used for the maintenance of the playground, which will be fully equipped when deeded to the association. As there are 325 building sites in the subdivision, the maintenance fund will amount approximately to $3,000 per year. After the five-year period, the property owners will be in a position either to form new plans for maintenance, or to continue the plan as put in force by the company.

Another Houston real estate operator who is making room for a playground in his new addition is E. H. Fleming, who in opening up "Southampton" has set aside 2½ acres for such a purpose and has offered it to the city authorities on condition that they develop and maintain it.

In the Norhill additions, the Varner Realty Company has provided several small park spaces suitable for playgrounds for small children and has built a baseball diamond on property jointly owned by the company and the city. The diamond ground has been deeded to the city on condition that certain improvements be made in that district by the municipal government.

CORINNE FONDE,
Executive Secretary, Houston Recreation & Community Service Association.

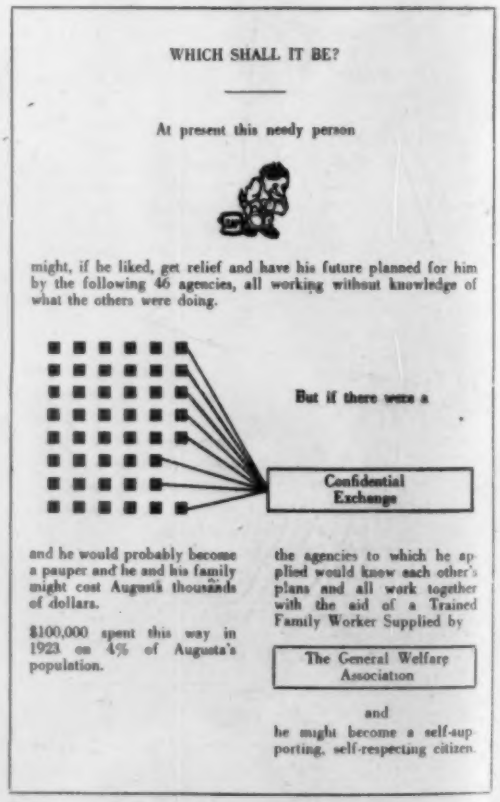
A City with a Program

AUGUSTA, GA.—The city has a community consciousness. She has just issued the printed report of the Augusta Survey, which is an attractive volume containing one of the most interesting community studies ever made. The story of the inception and carrying out of this project is enlightening and stimulating.

A short time ago a prominent merchant of Augusta, J. B. White, died, leaving a sum of $400,000 to be devoted to the common good of the people of Augusta. At once a chorus of suggestions arose as to how the money should be used; $250,000 of the amount was granted to specific institutions in the city before some far-seeing citizens began to ask themselves the question, why should we not spend the income of some of this money to find out just what our greatest needs are before going any further?

The idea took hold. The newspapers took it up. The Board of Commerce and the Service Clubs got behind it, until finally a petition was presented to the Georgia State Council of Social Agencies requesting the aid of the Council in making a thorough social and health study of the city. This petition was signed by the Mayor and by the president of every important civic and welfare organization in Augusta. The invitation was accepted and the State Council of Social Agencies enlisted the cooperation of various state and national organizations.

Carter Taylor, Director of Disaster Relief in the Southern Division of the American Red


WHICH SHALL IT BE?
At present this needy person
might, if he liked, get relief and have his future planned for him by the following 46 agencies, all working without knowledge of what the others were doing.
But if there were a
Confidential Exchange
and he would probably become a pauper and he and his family might cost Augusta thousands of dollars.
$100,000 spent this way in 1923 on 4% of Augusta's population.
the agencies to which he applied would know each other's plans and all work together with the aid of a Trained Family Worker Supplied by
The General Welfare Association
and
he might become a self-supporting, self-respecting citizen.

GRAPHIC PRESENTATION OF IDEAS IN THE AUGUSTA SURVEY

Cross, was loaned by that organization and served as Director of the Survey. Forty experts from various state and national organizations assisted in the study and guided the work of the three hundred citizens who volunteered their assistance in collecting the facts. As a result, Augusta now has a definite program upon which to work, covering the broad fields of family welfare, child welfare, education, recreation, housing, industry, agriculture, religious life, jails and health.

The committee on coordination found that there was great need for coordinating the activities of the different social agencies at work in the city, and recommended that a Council of Social Agencies be formed for this purpose. This has now been accomplished, so that the fruits of the Survey are already being enjoyed.

Augusta, therefore, must be ranked as a real go-getter: she first found out what she wanted; she then proceeded to get it.

ROBERT B. REED,
Executive Secretary, Augusta Council of Social Agencies.

SCHOOL GYMNASIUM AND COMMUNITY HALL IN DEER PARK, WASH.

Team-Work on a Community Building

DEER PARK, WASH.—At a considerable sacrifice on the part of its 1,400 inhabitants, Deer Park had for years maintained a four-year accredited high school for the young people of its own and the surrounding community, giving them the best obtainable in educational advantages, but realizing that they were hampered in their growth by the lack of a gymnasium and community hall. Bonds could have been voted had not the district already nearly reached its limit. At last a solution was found. The local Athletic Association offered to issue 5 per cent bonds in $25 denominations to the amount of $7,500, and after selling these buy a site and erect a building; then in turn rent this building to the school district for a reasonable sum, which, added to what the building might earn from other sources, would be sufficient to retire the bonds in a period of ten years, when the building would become the property of the school district.

With this plan, a committee went to work, and in ten hours the entire amount was subscribed by 127 persons. Work was started on November 19, 1923, and the building was dedicated on January 11, 1924, a remarkable record time when one considers that the building is 46 x 90 feet in size, with a gymnasium floor 46 x 74 feet, and has a balcony on two sides and one end, a stage, dressing-rooms with showers, and a fine hard maple floor.

During the construction the manual training class of the high school dug trenches, mixed concrete, nailed sheeting and, in fact, did a tremendous amount of work. When the roof was ready for shingles, the entire town turned out, and 66,000 shingles were put on the roof in one day by the citizens. About a hundred persons actually performed work on the building. An excellent dinner was prepared by the ladies.

Since completion, the building has been the scene of many a happy gathering, both for school and for community purposes. At a recent carnival sixteen different organizations of the town and surrounding country were represented by booths or exhibits, and nearly $300 was realized to apply on the bonds. Nearly every voter in the district is a bond holder and therefore a booster for the building, and the financial success of the undertaking seems assured. The building is serving its purpose, and one can easily see why TEAMWORK is spelled with capital letters in Deer Park.

L. C. McMAHAN,
Superintendent of Schools.

TYPE OF CAROUSEL INSTALLED IN PITTSBURGH PARKS

Pittsburgh's Carousels Are Popular

PITTSBURGH, PA.—Among the most popular pieces of recreational equipment in the parks of this city are the merry-go-rounds which were installed several years ago by the Bureau of Parks. Three of these carousels, of a type similar to that shown in the accompanying illustration, were purchased from the Philadelphia Toboggan Com-Company, of Germantown, Phila-

delphia, Pa., and were installed one in each of our two large parks, and the third in one of the smaller parks. They are kept in operation daily, free of charge, from May 30 to October 15, and we have found them to be a complete success as a means of providing healthy and safe recreation and entertainment for the many thousands of children in our city.

That the youngsters take good advantage of the opportunity for a ride on the merry-go-rounds is evident from the fact that during the summer of 1924 a total of 217,976 children were recorded as having been entertained in this way among the three parks.

After having given this recreational device a fair try-out over a number of years, we are satisfied that the carousels are a useful and attractive addition to our playground equipment, and that the investment involved has proved to be thoroughly worth while.

GEORGE W. BURKE, Superintendent,
Bureau of Parks.

A Small Town's Outdoor Theatre

DARLINGTON, S. C.—There was built last year at Darlington, in the rear of St. John's School, an outdoor theatre which has already proved itself of immense benefit to the community and has promise of becoming one of the most beautiful in the country. Unique in setting, it has for a background a typical South Carolina swamp with large Spanish moss-covered cypress trees and evergreen Darlington oaks; then in the rear of the foyer, it is tied in harmoniously with the school structure.

On a bronze tablet set in a boulder at the entrance will be found the following inscription:

This Theatre is dedicated
to
The happiness and cultivation of youth.
It is given by
Mary E. Woods Dargan
To the people of Darlington
in commemoration of the
life and service of
Edwin Keith Dargan
1841.....1911
His soul was modest as
his aim was high.
Dedicated.....1925

It is to be commended that this type of memorial was selected over others because of its rarity, its beauty, and its proved service to the community.

The theatre will be used for commencement and other special exercises of the school, also by civic organizations as a meeting-place and for social entertainments, and on special occasions by public speakers.

The theatre is on the direct axis of the building, with an enclosed foyer adjacent to the building. From the foyer lead three walks to the seating area, which slopes gradually to the stage. There is seating capacity for 2,000 people. The stage is slightly elevated and gives clear vision from each seat. Its surface is grass. There are large entrances on either side for pageant purposes, and smaller ones leading to dressing rooms in the rear. In front of the stage is a sunken orchestra pit, and in front of it is a reflecting pool which adds to the beauty and makes the acoustic qualities the very finest. The plans were drawn by E. S. Draper, landscape architect and engineer, of Charlotte and Atlanta.

The enthusiasm of the community was worked up during construction, resulting in donations of labor, materials, and much time. Between each two rows of seats there is a low, brick wall capped with cement. Between the walls there is a soft cushion of turf. The turf can be used as a seat, or, if desirable, a mat or portable chairs can be placed upon the turf. The excellent stand of grass was obtained by sprigging in Bermuda grass on a well-fertilized soil.

Planting is being carried out to complete the stage background and make the entire theatre a planted enclosure. Water-plants will be introduced in either end of the pool. Flowering shrubs are being set out to give a pleasing effect throughout the whole year.

To Darlington, already famous because of the oak which bears its name, the outdoor lover may go and observe an outdoor theatre where nature, art and beauty have been combined.

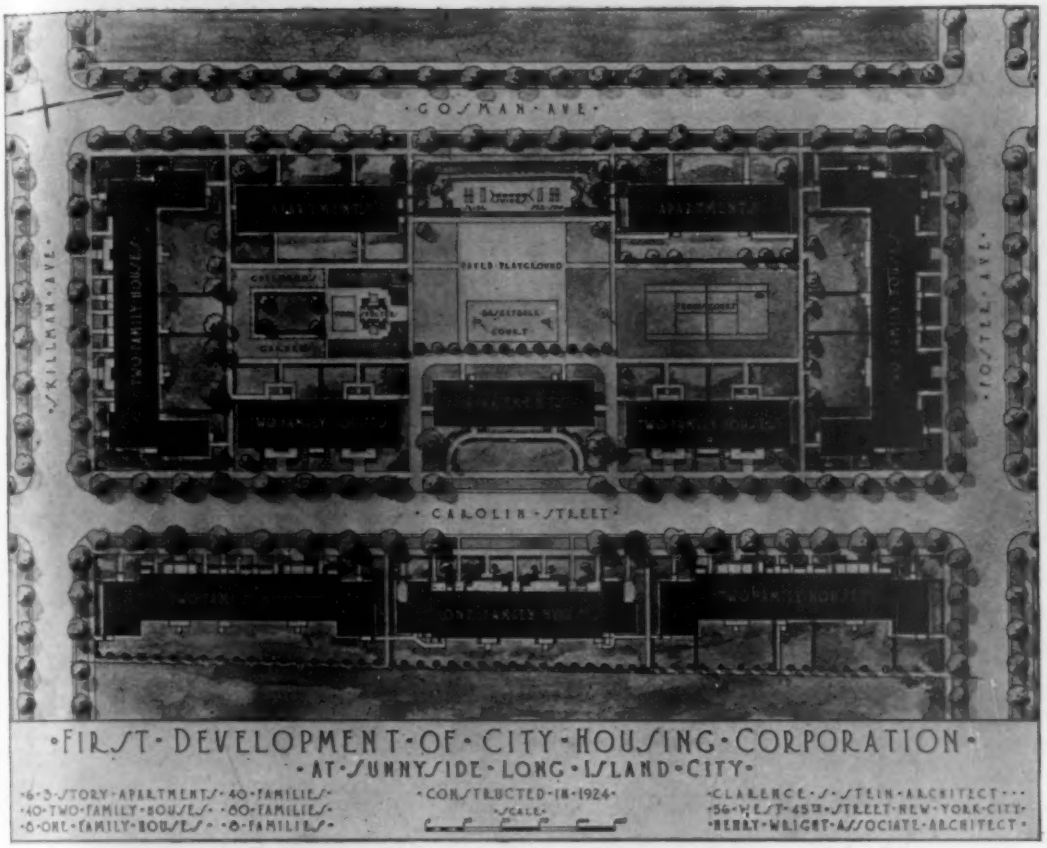
CHARLES GIDEON MACKINTOSH,
Landscape Contractor, High Point, N. C.

$13,525,000 in Bonds Voted by Chicago and Cook County

CHICAGO, ILL.,—At the local election on February 24 the voters of Chicago and Cook County approved seven propositions for the issuance of bonds aggregating $13,525,000, as follows:

CITY BONDS	
For the purchase of a site and the construction of a central police station and court building.....	$2,500,000
For completing track elevation work and the elimination of grade crossings in the Mayfair district..	1,500,000
For the purchase of sites and the construction of refuse incinerators and destructors; and for the purchase of sites for dumps for refuse disposal.....	1,000,000
For the extension and rehabilitation of the street-lighting system.....	1,000,000
For the purchase and improvement of sites for playgrounds, athletic fields and small parks.....	500,000
COUNTY BONDS	
For a new Criminal Court House and jail building, including a site therefor.	4,500,000

A VIEW FROM THE SIDE OF THE STAGE OF DARLINGTON'S OUTDOOR THEATRE, SHOWING THE SEATING ARRANGEMENT, WITH THE SCHOOL AND CAMPUS IN THE REAR


GOSMAN AVE
KILLMAN AVE
TOSTEL AVE
CAROLIN STREET
FIRST DEVELOPMENT OF CITY HOUSING CORPORATION
AT SUNNYSIDE LONG ISLAND CITY
6 3 STORY APARTMENT 40 FAMILIES
40 TWO FAMILY HOUSES 80 FAMILIES
6 ONE FAMILY HOUSES 6 FAMILIES
CONSTRUCTED IN 1924
CLARENCE S STEIN ARCHITECT
56 WEST 45TH STREET NEW YORK CITY
HENRY WRIGHT ASSOCIATE ARCHITECT

A New Venture in Housing

By Clarence S. Stein

IN all cities of America and Europe the fundamentals of the housing problem are similar. Particular requirements differ; the shortage may be more severe in New York City than elsewhere, but the same general principles apply. On this account the plans and achievements of the City Housing Corporation in New York may be of interest generally.

One fundamental is that adequate housing is not being constructed, and has not for at least a quarter of a century been constructed, to rent at a figure low enough to suit the needs of a majority of the wage-earning population. By far the greater part of the new building is for the highest-income groups; those who can pay less for rent have to be satisfied largely with the cast-off housing of the more fortunate, crowding it in a way for which it was never planned. This fact is inseparable from congestion and high rents.

The reason good houses are not built for low rents is not merely that there is more profit in the expensive houses. It also lies in the fact that with the methods customary in the industry there is little or no profit in cheaper ones. Plan after plan which has attempted to remedy the housing deficiency simply by restrictive legislation or by eliminating profit has been wrecked on this reef. Unless the methods of financing, planning and constructing houses are made much more efficient, inexpensive housing cannot pay its way. It must depend either on charity or on public subsidy. But there is not enough available for charity to meet a thousandth part of the need, and governmental subsidies for housing, though they have been adopted widely in Europe, have not as yet met with favor in this country.

The second fundamental is that even the housing which is constructed by speculative builders does not meet the need of the people for a healthy and sane community life. The urge for profit demands the use of every bit

HOMES AT SUNNYSIDE, LONG ISLAND CITY, N. Y.
Planned to give the maximum of light and air to each room. Every window looks out on a parked street or on the community playground

of space legally available, it crowds too many people on a given area, it does not provide enough light, air, playground or recreation space. The result is ill health, increased death-rate, neurotic children, overburdened transit, labor inefficiency, crime, and lowered community standards generally.

Unorganized private incentive, profit-making enterprise, the "law of supply and demand," however tempered by legislation or charity, have failed miserably either to put building operations on an efficient basis or to conserve human values, as far as the majority of the population is concerned. And the failure is increasing rather than diminishing.

The City Housing Corporation was formed after a study of the situation made by experts over a period of years. It recognized the need for more efficient methods, and decided that the way to apply them was by large-scale operations, associated with good planning and management. It recognized the need for better housing accommodations, and decided that it was desirable at once to improve the standard drastically, and on this basis to experiment with groups of house in an effort to discover what would best suit the needs of the occupants. It proposed to accomplish both these results on a self-sustaining basis, raising the necessary capital neither from profit-seeking sources nor from charity or subsidy, but from those who would invest in a public-service project of this kind for a return limited to 6 per cent, if assured of reasonable safety.

The Corporation has already constructed a housing unit for 128 families, and is about to finish another such unit. In these operations the following advances have been made:

1. The houses are being bought and maintained by the occupants for a monthly payment that is as low as rental charges for much more poorly constructed houses built by speculative builders.

2. Although law and custom in apartment house construction permit building on 70 per cent of the space in such a location, only 28 per cent of the space is built on, the rest being permanently reserved for playground, recreation, lawns, etc.

3. The houses are but two rooms deep from front to back, and those devoted to apartments are but three stories high. Every room has outside light and air, either from street or playground. There are no courts or shafts.

4. The houses are substantially built of brick. Up-keep charges will be much less than in the typical speculative house. Every detail of the plan and equipment has been endlessly studied for efficiency—efficiency and economy in construction, but, above all, efficiency and economy in living.

5. The buildings have been made attractive through their grouping rather than through ornamentation. Different heights of buildings, variety in setback, as well as a careful study of landscape work, have served to produce a much more attractive effect than would have been attained by individual building at much greater expense.

6. Single-family and two-family houses have been grouped with apartment houses. Although this is quite contrary to the customary method of development, it has in no way prevented the immediate sale of the houses and it helps to build up a homogeneous community of people of varied tastes.

7. Playgrounds and other recreational features are in the center of the block. Common interest in these helps to create a community spirit. No garages are permitted to clutter up the open spaces in the block. They are grouped in another portion of the development not far from the houses.

8. *In spite of the low price and the high standards, the Corporation, after six months' operation, had earned the full 6 per cent on its capital stock.*

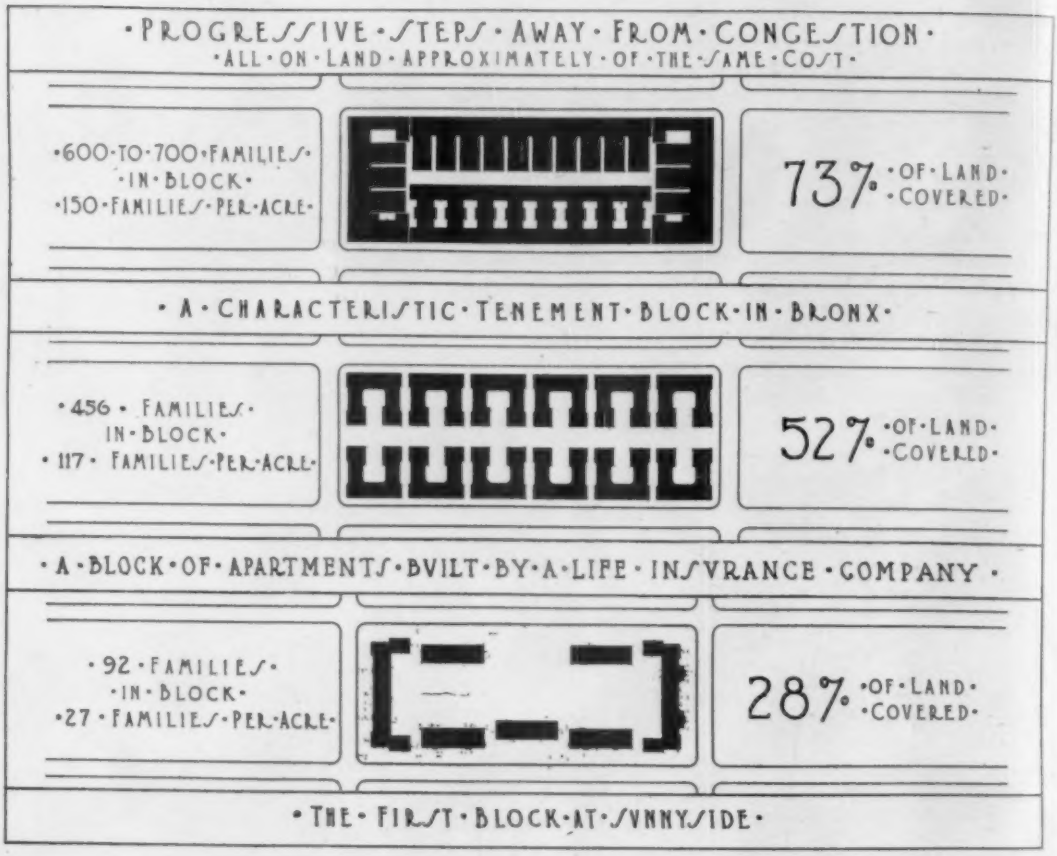
Large-Scale Operation and Expert Management

The efficiency of the work may be attributed to the scale of operation, which is now large and will become larger as time goes on, and the expert management. The large scale permits economy in every department.

Instead of buying a small parcel of land, improving that, and so raising the cost of neighboring land for future operations, the Corporation bought 1,100 lots at once. Although this tract is within walking distance of many factories in Long Island City, is on three rapid-transit lines, and is only twenty minutes from the Grand Central Station, the expert real-estate advice and the large bargaining power behind the Corporation enabled it to secure the land on favorable terms. Large orders for materials, the possibility of standardization in certain respects, the bargaining power furnished by the resources of the Corporation, and expert knowledge, brought down material costs. Labor costs were reduced not by wage cuts or anti-union drives—the Corporation deals with union labor in the ordinary way—but by good management. This consists in nearly continuous operation for a stable force of mechanics, who can gradually be selected on a basis of efficient work, and who are safeguarded against any temptation to go slow due to a fear that the job will be lost with the finishing of a given operation. Of course, with one organization administering the whole process from purchase of land to sale of houses, many minor economies are effected and profits eliminated. And the necessary capital was secured at 6 per cent rather than at the higher rates customary in building operations (outside of first mortgages) because persons sincerely interested in housing were willing to invest in a sound undertaking at that limited return. As the project continues, it will probably become apparent that a large-scale housing corporation of this nature is so favorably situated economically that its stock will rank in safety rather with the better industrials and public utilities—even with preferred stocks and bonds—than with the ordinary speculative real estate investment which under conditions hitherto prevailing in the industry had to offer a high yield to be attractive.

There are, of course, safeguards against the possibility that the houses will suffer speculative exploitation once they are built

THE CENTRAL AREA OF THE BLOCK AROUND WHICH THESE HOUSES AT SUNNYSIDE, LONG ISLAND CITY, ARE BUILT IS DEVOTED TO INDIVIDUAL GARDENS AND TO COMMUNITY PLAYGROUNDS


PROGRESSIVE STEPS AWAY FROM CONGESTION
ALL ON LAND APPROXIMATELY OF THE SAME COST
600 TO 700 FAMILIES IN BLOCK
150 FAMILIES PER ACRE
73% OF LAND COVERED
A CHARACTERISTIC TENEMENT BLOCK IN BRONX
456 FAMILIES IN BLOCK
117 FAMILIES PER ACRE
52% OF LAND COVERED
A BLOCK OF APARTMENTS BUILT BY A LIFE INSURANCE COMPANY
92 FAMILIES IN BLOCK
27 FAMILIES PER ACRE
28% OF LAND COVERED
THE FIRST BLOCK AT SUNNYSIDE

and occupied. They are sold only to bona fide occupants. They are practically restricted from sale during the first three years at a higher price, without the Corporation's consent. The title of the individual owner theoretically extends to the middle of the block, but the central portion, which is used for common purposes such as playground, cannot be built on for a period of forty years. Legal restrictions also include limitation to residential use, no private garages, no fences, alterations or changes of any kind in exterior of buildings without consent of the block committee. The apartment buildings are sold to cooperative associations which have their own provisions about such matters. Of course no foresight can absolutely insure that the purchasers will use their property for living rather than for speculative purposes, but it is possible to protect the structures themselves from destruction to make way for more profitable types, and it is hoped that the desirability of the housing and the development of community organization will tend to make for long-term occupancy rather than quick turnover with rising value.

The Corporation really went at housing on the basis of a public service industry. Its advisory board and board of directors include prominent representatives of many important groups in the community. Its staff is chosen from experienced experts. All this enhances the safety of the experiment both to the public and to the investor. There are plenty of well-situated, large tracts of vacant land in any city—even in New York—in which to continue operations. The capital employed is not tied up as in many housing projects, but is turned over by the sale of the houses—all the capital in a given house is returned, with interest, in fifteen years. As long as the company can continue to provide houses which are substantially more desirable than those furnished by prevailing standards of commercial construction, at the same price, or less, it will have no difficulty in selling them to reliable purchasers, and doing the occupants a very real service. In the meanwhile it is conducting valuable experiments in the nature of housing best adapted to civilized community life, and is aiding the development of that life through fostering cooperative groups to buy

the apartment houses, block committees to regulate the playgrounds, and so on.

This plan, of course, furnishes no direct attack on the problem of the slums or of existing tenements poorly constructed. Its prices are still too high to be available to the poorer tenants, and it does not tear down overcrowded sections to build anew. Its attack is rather one of encirclement and infiltration. It furnishes desirable living accommodations for the better-paid wage-earners and professional workers at prices well within their means, it forestalls the growth of new slums, and it gradually attracts city dwellers from the congested regions. Since it is self-sustaining, it presents possibilities of indefinite expansion such as charitable enterprises or those with frozen capital do not, and it may in the long run be able to tackle some of the larger tasks of community planning.

To Encourage Safe and Efficient Driving

THE following statement, issued last month by the National Safety Council, can be used to advantage, it is believed, by municipal officials, community safety councils and other local groups in their efforts to reduce the ever-increasing annual automobile accident death toll:

"A man may have a mechanically perfect car, but because of careless driving he may cause an accident that results in serious injury or death to himself or others.

"Reckless driving is not a demonstration of skill.

"A moment or two saved to-day by reckless speeding is not efficiency, for speeding to-morrow may result in a smash that will lay up the car for several days and you for several months. Hurrying to get ahead of a train, a street car or another vehicle saves only a moment or two at the ultimate destination and the gain is not worth the price: there is too much danger of accident.

"The best drivers are especially careful at dusk or twilight. There is then neither enough daylight nor sufficient artificial light to make objects distinguishable at ordinary distances.

"Slow up for all turns in the road. Blind corners are dangerous. When it is impossible to see what is coming from around the corner, be prepared to stop. Sound horn a short distance before reaching the intersection.

"Don't zig-zag from one side of the street to the other.

"Use chains of the Weed type whenever there is danger of skidding. Install chains on both rear wheels or none at all. Only one chain is sometimes worse than none. Chains on all four wheels help the steering of the car, especially if it is a four-wheeled drive car.

" Hitting ruts at too high a speed may cause the driver to lose control of his car.

"Drive slowly at bridges and at culverts. A bad rut or a stone in the road may throw your car against the structure.

"When attempting to pass another vehicle going in the same direction start turning out (to the left) at least 75 feet to the rear. If you get too close, your view of the road ahead is obstructed and you may turn directly in front of another car coming toward you. When you have passed a car, do not cut back into the road nor slow down too soon.

"Always be careful when backing. Sound horn; signal other cars and look back (not ahead) to see where you are going. Mirrors are valuable at all times. Bumpers also have a safety feature not to be overlooked.

"Clean wind-shields give you a clear view ahead. Every car should have a secondary wind-shield (rain visor) or wind-shield wiper which will prevent snow or rain from obstructing the driver's view.

"When driving, do not attempt to carry on a conversation with others in the car. Small children should preferably sit in the rear of the car; they should never be held in or between the arms of the driver. Safe driving demands your full and undivided attention.

"Be sure to signal when driving toward or away from the curb.

"The traffic officer has a difficult job at the best, and drivers should make every effort to assist him. He is responsible for all accidents which happen at his station. Let us treat him as we expect him to treat us."

Is Every Case of Typhoid an Accident?

IN the December 29, 1924, issue of *Health News* the New York State Department of Health quoted a decision of the Supreme Court of Illinois sustaining a judgment of the lower court of $1,130 in a case brought against an accident insurance company by the heirs of a man who died from typhoid fever. The effect of the decision will evidently be far-reaching, according to an article in a recent issue of the *Mutual Underwriter*, which comments on the decision as follows:

"It was claimed that the disease was contracted by drinking contaminated water, and that as this was done accidentally the accident policy should be liable. As this was regarded as a dangerous broadening of the accident policy the case was taken to the Appellate Court and then to the Supreme Court, the lower court being sustained in both cases. The insurance company then petitioned the Supreme Court for a rehearing, which has been denied. As the amount involved is not sufficient to carry the case to the Supreme Court of the United States, this disposes of the matter.

"It is claimed that under these conditions the companies will have to revise their accident policies by definitely excluding bacterial diseases caused by reception of germs. Claim men and attorneys say that under this decision any person having an accident policy could collect for typhoid fever, as it is always acquired from germs, and these are received accidentally and not intentionally. They also say that it would be as consistent to sue under an accident policy for pneumonia caused by accidentally catching cold, or for any other disease not contracted intentionally. They hold that under this decision most accident policies will become life insurance policies, and that while the insurance department will not license a company to issue an accident policy covering death from typhoid fever, the Supreme Court holds that an accident company must pay such a claim."

Are Standard Incinerator Specifications and Contract Tests Desirable?

A Series of Responses from Members of the Committee on Garbage and Refuse Disposal of the Sanitary Engineering Section of the American Public Health Association and Other Engineers

THE Committee on Garbage and Refuse Disposal of the Sanitary Engineering Section of the American Public Health Association has been seriously considering the possibility of framing general specifications for garbage and refuse incinerators together with a contract guarantee and test requirements. Opinions regarding the value of such specifications and tests were sought from members of the Committee and other sanitary engineers either in private practice or municipal employ. The results of this inquiry have been assembled and are here presented in abstract. Although some members of the Committee and a considerable number of other engineers seriously question the possibility of what is commonly known as a standard specification—owing largely to variations in conditions to be met in various localities and to the general state of the art—yet the consensus of opinion seems to be that something of the kind would be useful and to warrant the hope that at least a general outline for model incinerator specifications and contract tests can be formulated.

Opinions

C. M. Baker, State Sanitary Engineer, Wisconsin Board of Health, Madison, Wis.—Numerous inquiries are received from municipalities regarding the merits of different methods of garbage disposal. Each question is usually a problem in itself, the solution of which depends largely upon local conditions. Nevertheless, certain definite general standards should be adopted that would be of assistance and guidance to municipalities in adopting plans for garbage and refuse disposal. In some cases, particularly for smaller municipalities where conditions are not favorable to sanitary fill and where reduction would not be practicable, incineration is probably applicable. Standard specifications for incinerators would therefore be of material value to these communities. Simple, general specifications rather than detailed specifications, together with an outline of standard tests, would more particularly meet the needs of the smaller community. There is probably no branch of sanitary engineering that is in such chaotic condition as that of garbage and refuse disposal.

M. N. Baker, Associate Editor, Engineering News-Record, New York City.—Most incinerator specifications, contract guarantees and acceptance test requirements are loose in character. All of our cities should, as a few of them do, employ a competent engineer to design proposed garbage and refuse disposal plants of whatever type, to draw specifications and contract forms, and to supervise and report an acceptance test. Where it is thought desirable to permit contractors—whether manufacturers or general contractors—to submit their own detailed plans, specifications and guarantees, it is essential, if the bids are to be comparable, that they conform to a general scheme of requirements. Such a general scheme would also be helpful even where an engineer is engaged to draw detailed plans and specifications.

Samuel A. Greeley, Consulting Engineer, Chicago, Ill.—Plans for incinerators have so far been developed largely as patented processes in the hands of certain manufacturers and promoters and there has been little basis for deciding the work to be done in specifications. In this way, the first step in the development has been the actual purchase of incinerators under guarantees, and advertisements for bids have stated only the capacity desired and in some cases the height of the chimney. Manufacturers have offered their own guarantees. As a second step, cities undertook to get bids on a somewhat more comparable basis by outlining a uniform guarantee on which all manufacturers would bid, including also specifications of materials to be used, in some cases together with a general outline of the plans. This has, perhaps, been the usual method in the larger projects.

A development of recent years has been for the city to buy the rights to a certain type of incinerator which, after due consideration, they have selected as the best and then to secure from the manufacturer plans and specifications on which competitive bids may be taken for erection. This, for instance, was done at New Orleans in connection with the construction of incinerators. New York has recently purchased incinerators without competitive bids, or with competitive bids, much as they might do in buying a boiler or a chimney,

or the like. All other parts of the plant were built under competitive bids based on plans and specifications prepared by the city's engineer. This would relegate the incinerator to its proper importance on a cost basis with the plant as a whole, and perhaps might reduce the temptation for political interference.

A further movement, not yet far advanced in this country, is preparation by the city's engineers of plans and specifications for the entire project, followed by taking bids for construction. There is some analogy between this situation and that of the development of water filtration plants. A number of years ago filter-plant installation was in the hands of manufacturers and promoters having patented devices, and plants were sold with little engineering competition and in some cases under guarantees, some of which were rather absurd. Later on, engineers began to make detailed designs for all parts of the filter plant except the filter equipment. Now it is the practice to make detailed designs for all parts, so that any competent contractor can figure. This, at least, is our practice so far as the strainer system, pipe gallery and the like are concerned. The rate-controllers and loss-of-head gages are bought similarly to hardware, cement and other standard products. A very much better filter-plant design has resulted from this practice. At present, American practice is not ready to go much beyond the purchase of complete plants from manufacturers who have their own guarantees, but it is possible to select a furnace type with less controversy than to select an entire plant. The cost of the furnace would not be much over a third of the cost of the entire plant. It might be possible in this way to make up a general outline plan and specification and ask for proposals on types of furnace with only an indication as to cost. An engineer could then select the type of furnace and prepare plans and specifications for the entire project on which bids for construction could be taken. It is difficult to work out a standard specification, because, after all, it is the element of judgment based on experience that is mainly needed, and a standard specification would discourage rather than promote this. It should not be difficult to draw up an outline of garbage plant specifications, including guarantees and tests, and in the present stage of development this would be very helpful. In a way, it does not get at the root of the matter, which comes down to items of plant location, general arrangement of buildings, and detailed designs of furnace work. Perhaps some general recommendations on methods of procedure with reference to engineering work would be helpful along this line.

I. S. Osborn, Vice-President, C. O. Bartlett & Snow Company, Cleveland, Ohio.—With the large number of different opinions in connection with incinerator work, no doubt any specifications which were prepared by a committee would necessarily be more or less general. The conditions vary in cities as to the quality and quantity of refuse to be incinerated, so that a furnace designed to meet one set of conditions might be undesirable under another. If there is any way that the committee can outline general policies to be followed, whereby municipal officials will be somewhat safeguarded and assured of securing equipment that will satisfactorily meet these conditions, it would be well worth while. In many cases specifications do not have much bearing on the final selection that is made, as the decision often rests with a council committee, the members of which become, in their way of thinking, well educated in furnace design, or with the salesman who is the most adept in presenting his proposition or has done the most extensive preliminary work through political influence previous to the preparing of specifications or the awarding of contracts.

Frank A. Barbour, Consulting Engineer, Boston, Mass.—It might be possible to develop a specification—largely general in its requirements, but with more or less particular definition of certain necessary phases—which would serve a good purpose. It would be impossible to prepare standard specifications to cover all necessary requirements in any particular case. There would be danger that municipalities would accept such standard specifications as sufficient without adaptation to local conditions by a competent engineer. Specifications defining the character of the refuse to be burned, requiring a guarantee of performance based on the consumption of so many units of fuel per ton of refuse burned to satisfactory ash, with a test extending over a sufficient length of time to express the results, might be productive of good. A further guarantee of the labor hours required per ton of refuse, and a requirement that the contractor shall be responsible for six months for any parts shown to be defective within such period, with a retention of a small percentage of the contract price, might also be of value. The contract form should be similar to that used in contracts for pumping machinery—setting forth general requirements, stipulating the fulfillment of certain guarantees and economies, and

allowing the contractor under these general requirements to submit his own detailed specifications, which should be made part of the contract with the successful bidder.

George W. Fuller, Consulting Engineer, New York City.—It is doubtful if the committee could materially advance municipal sanitation by going into this technical phase of garbage disposal. The effort would be misunderstood and abused by non-technical officials and would perhaps hinder technical advisors of municipalities who would naturally desire to fit their specifications to local conditions, which vary materially from place to place.

John H. Gregory, Consulting Engineer, Johns Hopkins University.—It would be highly desirable if such a specification could be prepared. It would not be impossible, but might be difficult to prepare. For example, is the incinerator to burn mixed refuse and, if so, what percentage of ashes? Or is it to burn a mixture of garbage and rubbish, either wrapped or unwrapped? How is the material to be charged in the furnaces, and how would you prepare a standard specification which would permit of competitive bidding on a particular incinerator of highly specialized design? These questions are raised merely to show that a standard specification might require a number of alternative paragraphs to meet local conditions.

T. Chalkley Hatton, Chief Engineer, Milwaukee Sewerage Commission, Milwaukee, Wis.—The collection and disposal of garbage, especially the latter, is as much an engineering problem as is the disposal of sewage, and one which should not continue in the hands of the promoter. Garbage, like sewage, is complex in character, and its character should be studied scientifically, to the end that the proper type of apparatus for its successful disposal may be designed and properly operated. To obtain this result, the services of both the engineer and the chemist must be employed where neither is looking for special monetary considerations. Whether the solution of the problem is sufficiently advanced to warrant a committee of sanitary engineers in preparing general specifications covering design, construction and guarantees, is a matter for the committee to determine. The committee might well collect and publish in a comprehensive and readable form the existing reliable data on garbage disposal, sparing no type or process in such a publication, to the end, first, that the public may be informed of the state of the art, and, secondly, that by thus educating the public a change of attitude may occur which will result in calling in the services of the engineer and chemist. Then and then only can proper specifications and designs be formulated.

J. A. Jensen, Supervisor of Water-Works, Minneapolis, Minn. (entrusted by the city government with the question of incineration).—Standard specifications would be helpful, owing to the lack in many cases of efficient supervision, but such specifications should generously recognize the various successful types of incinerators. The design should be in accord with sound mechanical principles, and approved material should be used for construction. The tests should take into account the varying grades of refuse met with in different places—a matter that is usually lost sight of.

M. M. O'Shaughnessy, City Engineer, San Francisco, Calif.—The condition of garbage disposal plants in our large cities is a disgrace and a reflection on the engineering profession, which should have the matter in charge. Immense sums of money have been invested in fake incinerators enclosing expensive machinery which is never used or fails to function. Witness the suspension of incinerators and garbage disposal plants in Seattle, Atlanta, San Francisco, Los Angeles, and New York. Think of the crime of dumping garbage from New York in the ocean and polluting all the beaches up and down the shore line! By collaboration of engineering talent, incinerator specifications could be drawn which would serve as a standard for the city engineers of our large cities.

Stuart Purcell, Chief Engineer, Department of Public Improvements, Baltimore, Md.—It is practicable and desirable that standard specifications be drafted, as they would be a most valuable guide to municipal engineers, even though it might be necessary to modify them considerably to suit local conditions. Standard specifications would undoubtedly prevent the ill-advised expenditure of large sums of money—of which there are many instances—on the construction of plants which prove to be failures and are soon abandoned or operated with very unsatisfactory results and at great economic loss.

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Sewerage and Sewage Disposal at Pleasantville, N. Y.

By J. C. Harding, Jr.
Fuller and McClintock, Consulting Engineers, New York City

THE village of Pleasantville, N. Y., is a residential community located on the Harlem Division of the New York Central Railroad, some 30 miles north of New York City. The population is about 4,000 and the assessed valuation $4,250,000.

For the last ten years there has been considerable agitation in favor of installing sewers. The impervious nature of the soil and the nearness of ground water to the surface have made the use of cesspools a rather costly and unsatisfactory method of sewage disposal, this being particularly the case in the more thickly built-up business section of the village. The State Department of Health had received many complaints regarding unsanitary conditions, beginning in 1908, and recommended in 1916 that the village proceed with the solution of its sewerage problem. Nothing definite was done, however, until the fall of 1922, by which time the situation had become so acute that the natural growth of the village was being considerably retarded. An additional incentive to take action was the fact that the village desired to construct many concrete roads, which would make the installation of sewers very expensive in the future, and did not relish the idea of later having these roads interfered with. The Village Engineer, J. Oliver Derby, was ordered by the Board of Sewer Commissioners to prepare plans, specifications, estimates of cost, etc., for a sewerage system and disposal works and submit them to the State Department of Health and the State Engineer for approval. Mr. Derby obtained the services of Fuller & McClintock, consulting engineers, to assist him, and plans were prepared and were approved by the state authorities on October 5, 1923. The money for the work was voted by the taxpayers at an election held on December 18, and contracts were awarded in April for the construction of the sewerage system and disposal works.

The Sewerage System

Pleasantville is divided into two districts by the Saw Mill River. The western district is not at present as badly in need of sewers as the eastern, although there is some agitation

GENERAL VIEW OF PLEASANTVILLE SEWAGE DISPOSAL PLANT DURING CONSTRUCTION

for their early installation. Plans have been prepared for their construction, and when it is deemed advisable they will be built. The eastern district, which contains the business section, will be largely sewered at the present time. This district is on a rather steep slope, and the sewage from most of it can be brought to the disposal plant by gravity.

The principal items entering into the cost of the sewer construction are 34,000 feet of 8- to 15-inch sewers, 150 manholes, 9,000 cubic yards of rock excavation, and 10,000 feet of 5-inch house connections, which are carried to the curb every 50 feet in most instances. The contractor has used three steam trench excavators for his excavation work and has made good progress, although the work has been rendered rather difficult by the large amount of rock encountered and because ground water has been generally found a few feet from the surface, even in the higher parts of the village.

Great care was exercised in the sewer construction to get a water-tight job, and in most cases where sewers were below ground-water level, jointing compounds were substituted for the cement joints generally used. As there is low land between the disposal plant and the end of the 15-inch main sewer, it was found necessary to construct an inverted siphon to deliver the sewage by gravity at a high enough elevation to the treatment works. This siphon is about 1,700 feet long and consists of two lines of cast iron pipe, one 8 inches and the other 12 inches in diameter.

General Features of Disposal Plant

The three most important factors in the design of the disposal plant were, first, the high degree of purification required; second, the necessity of having a minimum loss of head; and, third, the rather limited area of ground available and its nearness to a residential section.

The effluent from the treatment works will be discharged into the Saw Mill River, which is a small stream having a watershed area above the disposal works of about 5 square miles. Some 13 miles below the works, the city of Yonkers uses the stream as a source of water-supply. The watershed area above the Yonkers intake is only 23.81 square miles, so that the dilution is relatively small in dry weather, and although the water is filtered before drinking, a high degree of purification of any waters tending to pollute the stream should be required.

Because of the desire to obviate the pumping of sewage as much as possible, it was necessary to keep the loss of head in the plant at a minimum.

The plant is located in the center of a plot of ground owned by the village. The surrounding territory is fairly well built up on one side with residences of a modest type, the nearest being on one of the main highways about 600 feet away. The disposal works are about one-half mile from the business center of the village.

Although the total area of ground owned at the site by the village is some 16 acres, a large part of it is low and swampy at times of high water in the stream. This condition limits the area of ground available for the plant without considerable expense for removing poor material and substituting fills of the proper character.

These three factors led to the choice of the type of plant built. The high degree of purity required of the effluent meant that a process capable of providing relatively complete purification must be chosen. This practically narrowed the field to either sand filtration or the activated sludge process. Of these two, sand filtration was preferred, because of the small size of the installation, the larger factor of safety provided against inefficient operation, and the fact that New York City had long used this process to protect its water-supply, therefore establishing a local precedent favoring its use.

After deciding on sand filtration, it was apparent that if this process was used alone the expense of preparing land and importing sand would be considerable. Furthermore, as it was desirable to have the installation as compact as possible, it was decided to employ some preliminary treatment of the sewage before applying it to filter beds and, in addition, to the usual sedimentation tanks. Both trickling filters and single and double contact beds were considered for this purpose, but the smaller loss of head through single contact beds favored their choice, together with the fact that trickling filters might possibly cause a nuisance on account of odors, which must be prevented because of the close proximity of residences.

The disposal works are composed of preliminary settling tanks of the Imhoff type, contact filters, secondary or final settling basins, sand filters and sludge beds. They cover a total area of about 2½ acres. The tanks were designed for a tributary population of 5,000, and the filters for 3,000. The sewage passes first through bar screens, which remove the grosser suspended solids, then through the Imhoff tank, in which much of the settling solids is deposited. After leaving the Imhoff tank, the sewage receives preliminary filtra-

CONSTRUCTION SCENE AT PLEASANTVILLE SEWAGE DISPOSAL PLANT
Dumping stone from industrial railway cars onto completed underdrain system in contact beds. Sand filter for effluent shown in background

tion in the contact beds, is again settled in the secondary sedimentation basins, and after final filtration in the sand beds the effluent passes to the Saw Mill River.

Bar Screens.—The screens, two in number, are of the bar type and are located in the inlet channel of the Imhoff tank. They have openings of 1⅜-inches and have a total area of 19.5 square feet each. Only one screen will be used at time, depending on the direction of flow through the tanks.

Imhoff Tank.—The Imhoff tank is divided into two units. Each unit is about 35 feet long, 17 feet wide, and 21 feet deep. The settling compartments of the tank have a total capacity of 40,000 gallons or the equivalent of about 2 hours' detention at average rates of flow of 500,000 gallons daily. Solids settling in the settling compartments are deposited on the bottom, which has a slope of 1.2 on 1, and pass through a slot 6 inches wide into the sludge compartments.

The sludge compartments have a capacity of about 2 cubic feet per capita. The bottoms are divided into hoppers, four in all, from which lead 8-inch cast-iron pipes to the sludge beds. Gas vents are provided in the center and on the sides of each tank. The total area of gas vents is about 30 per cent of the area of the tanks. Channels and stop-valves are provided so that the flow through the tanks can be reversed to equalize the deposits of sludge in the hoppers.

Contact Beds.—The settled effluent from the Imhoff tank will pass to the contact beds. These beds are three in number and are fed in turn by means of automatic dosing devices. The beds are 100 feet long, 72 feet 6 inches wide, and have a depth of about 6 feet. Their total area is ½-acre, so that the rate of filtration will be about 600,000 gallons per acre. Trap rock between the sizes of 1 and 2½ inches is used for the filtering material. The sewage is applied through a line of 12-inch tile pipe, laid with open joints. The drainage is provided by means of a false bottom of 6-inch split tile pipe, which carries the effluent to a main drain leading to the withdraw siphons, which automatically drain the beds.

Secondary Settling Tanks.—The effluent from the contact beds is settled in the secondary settling tanks. These tanks are two in number and are 25 feet 6 inches long, 15 feet wide, and 9½ feet deep. Their total capacity is about 50,000 gallons. The settled sludge is collected in four hoppers and withdrawn by means of an 8-inch cast iron pipe line to the sludge beds. The outlet channel is provided with stop-gates for dosing the sand filters.

Sand Filters.—The sand filters are three in number and are each 100 feet long and 72 feet 6 inches wide. They cover a total area of one-half an acre. The beds have a depth of sand of 2 feet 3 inches, the sand being placed upon graded crushed stone. The underdrainage is provided for by 4-inch tile pipes laid with open joints on 18-foot centers, these pipes running into a 12-inch main drain leading to the outfall sewer.

Sludge Beds.—The sludge drying bed is about 60 feet by 50 feet in plan and provides

an area of about 1 square foot per capita. It is divided into three sections by wooden baffles. The sludge is discharged over concrete aprons at one end of each section. The filtering material consists of about 1 foot of sand, which is underdrained by 4-inch pipes leading to the effluent line of the sand filters.

Costs

Landscaping.—The surroundings of the plant will be made very attractive in the near future, as the land near-by has been purchased for parkway purposes as part of an inter-county highway system. The parkway authorities intend to landscape the disposal works, and therefore one of the leading objections to a sewage disposal plant—unsightliness—will be removed.

Present indications are that the sewerage system and disposal works will cost about $315,000, including rights of way, engineering, supervision, etc. This amount was raised by two bond issues, one for $225,000 and a second for $90,000; of this sum, $130,000 will be paid by the village at large and the remainder assessed upon the property benefited directly by the improvement, and that which will be indirectly benefited by the trunk lines to which the lateral sewers to be built later will connect, and also by the disposal plant.

Joseph Miele of South Orange, N. J., had the contract for the sewers, and Hennessy & Sowell of Camden, N. J., the contract for the disposal works. J. Oliver Derby is Village Engineer, and Fuller & McClintock are the consulting engineers.

A Smoke Abatement Investigation That Produced Results

THE results of a smoke abatement investigation conducted by Interior Department engineers at Grafton, W. Va., where property damage from bad smoke conditions was estimated at $300,000 annually, are outlined in Technical Paper 338, recently issued by the Bureau of Mines.

Smoke conditions in Grafton, an important railroad junction, are influenced by a number of local factors that make the situation particularly difficult. The combination of high hills, low wind velocity, fogs, heavy railroad traffic, and the situation of the business district immediately adjacent to the greatest railroad activity, is probably not duplicated in any other railroad center in this country.

Locomotives in country districts having no smoke supervision show an average smoke density of 49 per cent. At Grafton the density of locomotive smoke during the first three months of observation by the Bureau of Mines equaled and often exceeded this figure. Individual engines under observation during this time showed smoke densities higher than had ever before been recorded in any smoke campaign in the United States. The fall of sooty solid matter recorded in the downtown section is as high as any on record.

The damage caused by this condition is difficult to figure in dollars and cents. It has been one of the main factors in holding back the growth of the city, and for this reason alone the loss to the community has been incalculable. The estimated per capita damage by smoke in American cities, due to the cost of the extra cleaning of rugs, carpets, curtains, household furniture, and interior and exterior decoration; laundry, and wear and tear on clothing, and the effect on stocks of goods in warehouses and stores, has ranged from $12 to $17 a year. In comparison with other localities where this per capita damage has been estimated, the first three months' observations at Grafton would indicate an estimate of $30 per capita as conservative. To this figure must be added the enormous but intangible loss to the community through the continual smokiness. Smoke from railroad activity of one form or another is responsible for practically 90 per cent of all the smoke in this territory.

That smoke conditions in the city could be greatly bettered was shown as a result of the campaign. In an effort to improve smoke conditions in Grafton, the railroad and other interested parties were asked for cooperation. The railroad management responded in a highly gratifying manner, assisting in every possible way through various branches of the motive power division. In sixty days more than half of the smoke from locomotives was eliminated, and a very material reduction in smoke was made at the roundhouse and shops.

Experiments during the last 10 years have demonstrated that smoke from roundhouses can be reduced to a minimum by the judicious use of blowers and by the proper method of starting fires. Cleaning fires on the cinder pit is generally productive of much smoke. This smoke can be greatly reduced by igniting the fresh coal from the top, as in starting a new fire.

A large amount of the smoke made in Grafton comes from engines held under steam in the yard. Smoke from this source can be controlled by careful firing and the proper use of the blower. Engines on the road can run without dense smoke if proper methods of firing are used. Road engines standing on track can be kept clean by the proper use of the blower, by judicious firing, and possibly by "cracking" the door. There is practically no excuse for black smoke from road engines standing on track. Standard equipment has been developed for locomotive operation which aids the fireman to keep down smoke while his engine is in the terminal.

Details of the smoke abatement investigation at Grafton are contained in Technical Paper 338, by Osborn Monnett, consulting engineer, and L. Russell Hughes, physical chemist, copies of which may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C.

The New Municipal Light Plant in Muscatine, Iowa

By Arthur L. Mullergren
Consulting Engineer, Kansas City, Mo.

THE city of Muscatine has just completed an entire new municipal electric light plant and electric distribution system for serving the commercial and municipal light and power requirements of the city. Prior to the completion of this plant, the city was served by a transmission line from a generating station at Davenport, Iowa. The station, as well as the transmission and distribution system in the city, was owned and operated by a subsidiary company of the United Light & Railways Company. This company also had a steam reserve station in the city of Muscatine. The new municipal plant will operate in competition with the existing utility company for the commercial business, and in adidtion will handle the entire street-lighting and water-pumping requirements of the city.

EXTERIOR OF MUNICIPAL POWER-PLANT, MUSCATINE, IA.

Muscatine has a population of 17,000 and has an unusual number of industries for the population. It is one of the oldest pearl-button manufacturing cities in the country, and there are a considerable number of these factories in the city. Consequently, a central station would have a very good load factor if all of the available business was secured.

The new municipal plant has been designed for an ultimate capacity of 6,000 kw. and the present building constructed so as to house 3,500 kw. The initial installation of equipment consists of two Westinghouse 750-kw., 6,600-volt, 3-phase, 60-cycle steam-turbine-driven generating units.

ARRANGEMENT OF CONDENSING EQUIPMENT AND TURBINE FOUNDATION

A study was made of the possible load factor and operating conditions in the city to determine the most suitable type of prime mover. It was determined that within two years the plant would be operating at an annual load factor of 60 per cent, owing to the amount and kind of industrial power business available and the excellent water-pumping arrangement. Inasmuch as the plant would have an installed capacity of 3,500 kilowatts within two years

and 6,000 kilowatts within seven years, the unaflow type steam engine was eliminated from consideration, as such an installation would involve too many units if we kept to the present commercial sizes; furthermore, the unaflow engines offered no greater economy in operation than turbines, owing to the favorable load factor of the plant and system.

A thorough study was made of the diesel oil engine, and comparisons were made of the total annual costs, with the costs of steam turbines, including all operating and fixed charges. The following costs were arrived at for these two types of plants. The figures given are cents per kilowatt-hour of generated output at the switchboard:

	Plant Production Costs	Fixed Charges	Total Costs
At 60 per cent load factor:			
Diesel engines	.75	1.00	1.75
Steam turbines	1.07	.68	1.75
At 40 per cent load factor:			
Diesel engines	.88	1.42	2.30
Steam turbines	1.34	.94	2.28

NOTE.—The following is the basis of calculation of the foregoing figures: Coal, 11,000 B.T.U., $4.25 per ton delivered in storage; oil, 18,000 B.T.U., $.05 per gallon delivered in storage; boiler efficiency, 72 per cent; turbine economy, 17 pounds steam per kw. hr.; diesel engine economy, 0.7 pounds oil per kw. hr.; fixed charges on both types of plants, 18 per cent, determined as follows: interest 5 per cent, depreciation 5 per cent, maintenance 2 per cent, insurance, etc., 1 per cent.

The steam turbine plant, substation and distributing system complete, was estimated to cost $425,000, and the diesel plant and system $525,000. Since there was no difference in the total annual charges of the plants and the diesel plant's initial cost was $100,000 greater, and a further gain would be made in the ultimate turbine installation, it was decided to use the steam turbines.

After a thorough investigation of available sites, it was finally decided that the most advantageous and desirable location would be on what is known as Muscatine Island, about 2½ miles from the business district. This site was chosen for two reasons: first, an adequate supply of good, cold condensing water was available; second, the existing municipal water-works pumping-station was located here, and by combining the two plants, better supervision and operation would be obtained with an attendant reduction in operating expenses. The city water-supply is obtained from a number of drilled wells, 12 inches in diameter, and approximately 50 feet deep, and it was ascertained that each well was capable of yielding 1½ million gallons per day of water that had a constant temperature of 52 degrees the year round. It was determined to use this same source of supply for condensing water for the new municipal plant, and two additional wells of the above size were drilled for the condensing water-supply. Since the city water-works has secured its water from this source for over twenty years and has shown no decrease, it was felt that an ample supply for all future requirements would be obtained. The water rises in the wells to within 10 feet of the surface and maintains this level when pumping at the rate of 1½ million gallons per day.

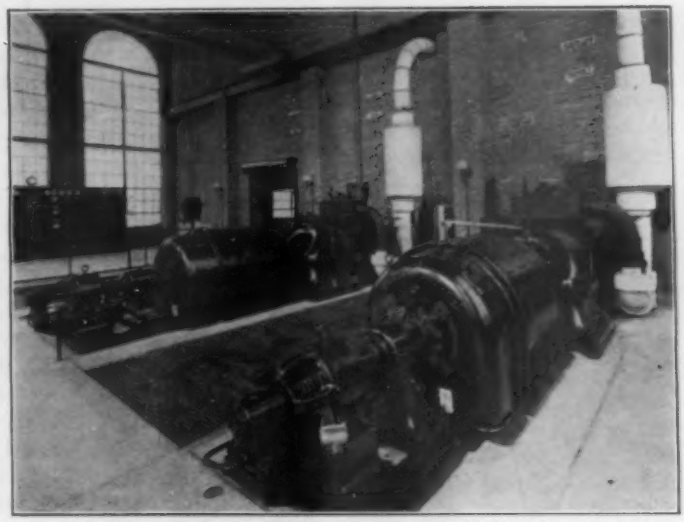
Condensing Equipment

The condensing equipment consists of two 1,500-square foot Westinghouse two-pass, surface condensers, connected directly to the turbines immediately below them, a sufficient basement being provided for this purpose. Liberal but not excessive space is provided in the basement for the equipment, and sufficient natural light is secured for maintaining and operating it. All of the auxiliary equipment for the condensers is motor-driven. The circulating pump, which has a capacity of 1,200 gallons per minute, is of the centrifugal single-stage type, direct-connected to a 30-h.p. motor, and lifts the water directly from the wells, discharging it through the condenser, and thence into the Mississippi River. It was found to be more economical to waste this water than to attempt to re-cool it by means of a spray pond or cooling tower, or to install a water-works type condenser for the purpose of passing the discharge water from the condenser for use in the city water-supply. All the motors for the condensing equipment have automatic push-button controls. The piping is arranged so that condensing water can be secured in emergency cases direct from the high-service pumps of the city water-pumping plant through a pressure-reducing valve located by the circulating pumps and under the control of the electric plant operator. The air pump is of the Westinghouse LeBlanc hydraulic motor-driven type. Owing to the fact that the floor of the basement is below the high-water of the Mississippi River, and it is necessary for the air pump discharge to operate against practically no head, it has been necessary to provide an auxiliary tank or concrete basin in the basement for recirculation of the air pump water during the high-water period, which is from three weeks to six weeks in each year.

Generators

The turbo-generators are installed on reinforced concrete foundations, which are inde-

pendent of the building and are supported on reinforced concrete mats, 22 feet below the base of the turbine. It was necessary to carry the foundations down to the depth indicated and provide a reinforced concrete mat, owing to the fact that during the high-water period the water backs up from the river through the underground strata so that the entire area is underlain with water at a depth of about 10 feet below the ground surface. It was decided to generate at 6,600-volt, 3-phase and transmit this voltage to a substation located in the center of the city and distribute from the substation. The turbines are of the standard Westinghouse combined impulse-reaction type.



TURBINE ROOM, SHOWING ARRANGEMENT OF EQUIPMENT

The switchboard is of the Westinghouse make and consists of eleven panels arranged as follows:

Swinging bracket and instruments
Panel No. 1, 750-kw., 6,600-volt 3-phase generator
Panel No. 2, 750-kw., 6,600-volt 3-phase generator
Panel No. 3, blank for future generator
Panel No. 4, exciter panel
Panel No. 5, exciter panel
Panel No. 6, automatic generator voltage regulator
Panel No. 7, totalizing panel
Panel No. 8, 6,600-volt, 3-phase feeder panel (2,-500-kw.)
Panel No. 9, blank for future feeder as No. 8.
Panel No. 10, synchronous motors for water-works
Panel No. 11, station equipment

Blank panels have been installed to provide for a future generating unit and a future transmission line. The line will be a duplicate of the one installed. All high-voltage equipment is located in the basement in concrete bus and switch cells. On the main turbine floor there is no high-voltage wiring or equipment. The high-voltage switchroom is on a level with the condenser floor and separated therefrom by reinforcd concrete walls provided with steel fire-doors.

Installed in the turbine room is a Whiting 15-ton hand-operated traveling crane with a sufficient lift to handle equipment from the basement through openings provided in the turbine-room floor for this purpose. Removable Irving floor grating is provided between the turbines for basement ventilation and also for removing equipment in the basement. Space for a future 2,000-kw. turbine has been left open, with a hand railing around the space.

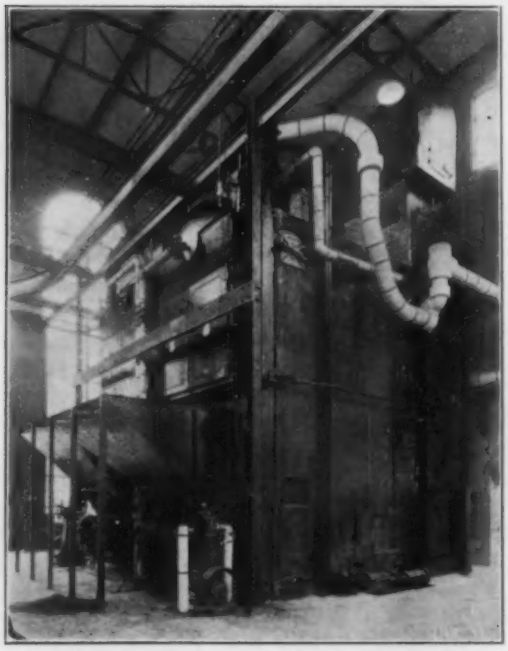
Boiler Room

The boiler room is immediately adjacent to the turbine room, and the boiler-room floor is on the same level as the turbine-room floor. The present boilers consist of two Heine 300-h.p., 200-pound working pressure, longitudinal drum boilers, set in battery. Sufficient space has been left for a future 500-h.p. boiler in the present building. The boilers are set so as to have approximately 3 cubic feet of combustion chamber per rated horse-power, the lower row of tubes being 12 feet from the floor. The boilers are vertically baffled with Turner baffles of the diagonal type, and the two lower rows of tubes of the boilers are arranged on rectangular centers so that the T-tile may be inserted from the furnace chamber. Each boiler is provided with Diamond valve-in-head soot blowers of seven units. The superheater is of Foster make and designed for 150 degrees of superheat when operating the boilers at 175 per cent rating. Each boiler is provided with a Westinghouse four-retort underfeed stoker equipped with side wall tuyeres and steam ash dumps. Forced draft is provided by means of steam-turbine-driven blowers which are installed in duplicate, either blower having sufficient capacity to operate both boilers at 250 per cent rating. The stokers are driven by two Wachs vertical enclosed steam engines arranged so that either engine can operate either one or both stokers. The combustion chamber is of somewhat unusual design for a small installation. The rear wall of the boiler is supported on two steel I-beams, and the space between the rear of the combustion chamber and the rear supporting columns is left open. The ashes are dumped into an ash hopper and unloaded by hand into an ash car which runs directly in front of the

doors. The ash car is removed by means of the overhead monorail system. Sprinkler pipes are installed in the ash hopper, with a valve control by the steam ash dump, so as to quench the hot ashes as they are dumped.

The boiler settings consist of 22-inch-thick solid outside walls, with 13 inches of fire-brick, and the division wall, 26 inches thick, entirely of fire-brick. No insulating brick or air space is provided in the setting, but an insulation on the entire outside area of the brick setting was installed. This insulation consists of three coats of coal tar and asbestos wool, a plastic asbestos cement 1¼ inches thick, and over this chicken wire of 2-inch mesh stretched and tied to wire loops inserted in the brick setting during its construction, every sixth course. Over the wire mesh another coat of asbestos cement ¾-inch thick is applied, and the surface is then covered with 10-ounce canvas tightly pasted down and fastened by metal clips to the steel work of the setting. Two coats of asphalt paint are then applied. This insulation proved very effective during recent tests.

Steel extension hoppers have been constructed over the stoker hoppers and have sufficient capacity for a five-hour run at 200 per cent boiler rating. Coal is supplied to these hoppers by means of a Shepard 3-ton monorail carriage and hoist on which is installed a removable clam-shell bucket. This equipment is used to unload coal direct from cars and dump into storage along the monorail route, and also to take the coal from this storage or direct from the railroad cars and dump it into the hoppers. The monorail structures are of the steel A-frame type with concrete foundations and are spaced 15 feet on centers. The length of the monorail is 400 feet, and approximately 2,000 tons of coal can be stored and handled by this monorail. A railroad switch passes directly under the monorail at its far end, so that the cars can be unloaded directly by the monorail. This same monorail system is used to remove the ashes from the basement of the boiler room by simply detaching the clam-shell bucket, which is of the single-line type, and picking up the ash car and dumping it at the ash storage, which is at the end of the monorail. The monorail system is capable of delivering 125 tons of coal per day to the stoker hoppers. This system has been planned so that when the additional boiler is installed, a bucket conveyor and apron feeder type of coal-handling equipment will be installed immediately outside the boiler room for conveying coal to overhead bunkers, and will be fed by gravity therefrom direct to the stoker hoppers. The boiler-room height and width have been planned so that the overhead bunkers can be installed without making any change in the building design. The ultimate scheme will be to utilize the monorail for dumping coal into an enlarged concrete pit adjacent to the boiler room. The coal will be conveyed from this pit to the overhead bunkers by means of the apron feeder and bucket conveyor. When this ultimate development has been made, a steam jet ash conveyor will be installed in place of the ash car, and the ashes will be loaded direct into railroad cars on a siding immediately adjacent to the building.



BOILERS AND BOILER-ROOM EQUIPMENT
This illustration shows the arrangement of the piping for the superheater and to the main steam header, as well as the monorail system overhead which brings the coal into the hoppers above the mechanical stoker

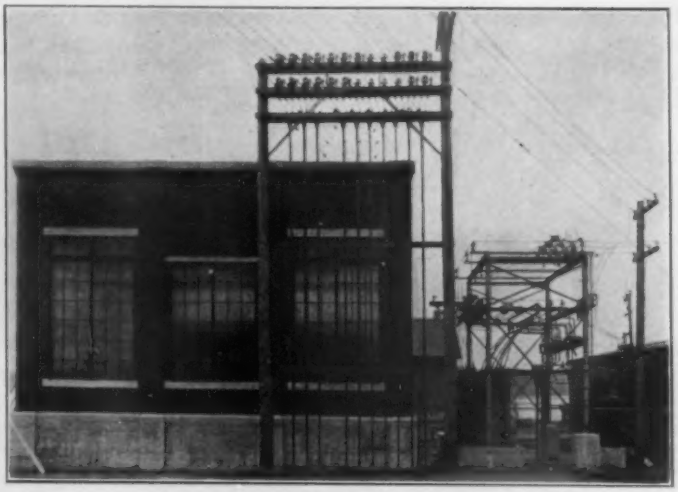
The monorail is operated by a 10-h.p., 3-phase, 220-volt motor, and the hoisting equipment by a 5-h.p., 3-phase, 220-volt motor. Current is supplied to these motors by means of three T-bar conductors and sliding shoes. The speed of the monorail is about 400 feet per minute. The coal supply to the boilers is measured by means of revolution counters placed on the stoker shaft. The measurement has been found fairly accurate.

The boiler-feed pumps are of the outside end-packed, pot valve duplex type, two being installed, and each having a capacity of 125 gallons per minute. The heater is of the Cochrane open type with oil purifier and is

of 1,500-h.p. capacity.

The stack is of Weber reinforced concrete design, 150 feet high and 72 inches top diameter, with radial fire-brick lining. The breeching is of No. 8 gage steel of the wagon-top design. It has been set on the present 300-h.p. boilers with a high uptake, so as to be in line with the future 500-h.p. boiler.

All high-pressure steam piping and fittings are of extra-heavy open-hearth steel and are provided with Van Stone joints. The insulation is of the Johns-Manville fire-felt type with 85 per cent magnesia covering. The main steam header is located on the boiler room rear wall. Large vertical cast steel receiver separators are installed at each turbine. The header is of the cast steel type, with all nozzles for connections cast integral with the header. In addition to the superheated high-pressure steam lines, a saturated steam line is taken directly off the boiler nozzle for supplying saturated steam to the existing compound pumping engines installed in the old water-works plant. These engines will be used for emergency purposes only. This was done to provide a duplicate source of power for water-pumping purposes to comply with the Underwriters' requirements. The entire piping system has been designed to prevent any interruptions to service due to failure of any of the equipment in the plant.



SUBSTATION, DISTRIBUTING TOWER AND OUTDOOR SUBSTATION EQUIPMENT

Water-Works Electrically Operated

Since it was decided to operate the municipal plant in connection with the water-works, the two buildings were tied together and new electrically operated water-works pumps installed. The existing steam water-works pumping equipment was not disturbed in any way, and sufficient space was found in the existing water-works plant to install two 3-million-gallon-per-day, 2-stage 100-pound-pressure DeLaval centrifugal pumps, each direct-connected to a 200-kv.-amp., 6,600-volt, 3-phase, 60-cycle synchronous motor. These synchronous motors are oversize and were installed for the purpose of power factor correction of the generating station, since this pumping equipment could be operated continuously if necessary. The above motors will correct the power factor of the plant from 75 per cent lagging to 90 per cent lagging when the external load on the plant is 1,500 kw. The motors are of the Electric Machinery Company's make and are provided with automatic push-button control starting and synchronizing equipment. A motor-driven geared type Simplex vacuum pump has been installed for priming the centrifugal pumps. The operation of the water-works equipment is under

COST DATA—MUSCATINE, IOWA, MUNICIPAL PLANT

Power Station	Total Cost Installed	Cost per Kw. Installed
Steam turbine-generators	$43,000.00	$28.75
Surface condensers	12,500.00	8.30
Boilers, superheaters, soot-blowers	32,000.00	21.25
Stokers, engines and forced-draft equipment	12,500.00	8.35
Coal handling equipment complete	18,000.00	12.00
Boiler-room accessories	10,000.00	6.65
Switchboard	12,000.00	8.00
Crane	3,000.00	2.00
Stack and breeching	8,000.00	5.35
Steam, exhaust, condenser, and all plant piping and insulation	21,500.00	14.35
Building and foundations	58,000.00	38.75
Wells and equipment	2,000.00	1.35
Station cables and wiring	2,500.00	1.65
Total station cost	$235,000.00	$156.25
SUBSTATION		
Building	$7,500.00	$5.00
Switchboard	7,000.00	4.70
Outdoor transformers, Delta-Star steel outdoor substation and equipment	7,500.00	5.00
Station cables and outside distributing rack	3,000.00	2.00
Total substation cost	$25,000.00	$16.70
Complete distribution, transmission and street lighting systems, covering entire city.... Cost per capita, $7.05.	120,000.00	8.00
Water pumping equipment and piping complete	15,000.00	...
Engineering and incidentals	30,000.00	2.00

NOTE.—Power station building, piping and accessories complete and ready to receive additional one 2,000 kw. turbine and condensing equipment and one 500 H.P. boiler, which equipment installed would cost an added amount of $115,000.00, thus making total power station cost $350,000.00 for 3,500 kw. capacity, or $100.00 per kw.

the immediate supervision of the chief engineer of the lighting plant, so that any desired arrangement of operation can be effected to improve the power and load factors.

The city has an unusually large water storage reservoir under pressure, which makes a satisfactory plant-operating condition. The city will at all times be protected in its water-supply, as the old steam pumping plant still has its old boiler plant and also can take saturated steam from the new boiler plant of the electric light plant, and in addition has the new electrically operated pumping equipment in duplicate, either electrically operated pump being able to take care of the normal requirements of the city.

The building is of reinforced concrete and brick and has been constructed so that the highest known water will not interfere with the operations. The floor level of the power-plant is about 4 feet above the highest known water, and the entire basement is waterproofed so that no overflow or back-water from the underflow will get into the plant. The entire substructure has been well reinforced and waterproofed and provided with sufficient foundations to prevent settlement in case of an extended period of high water. The current is transmitted from the power-station at 6,600-volt, 3-phase to a substation located near the load center of the city. The substation houses a 13-panel switchboard and regulators, from which all feeder and distributing lines throughout the city are metered and controlled. The current is stepped down from 6,600 to 2,300 volts, which is the distributing voltage, and for this purpose an outdoor Delta Star steel substation was installed.

The cost of the entire project, including the outside distributing system, was $425,000 and was defrayed out of a bond issue voted for this purpose. The entire plant and system was designed and the construction supervised by the author.

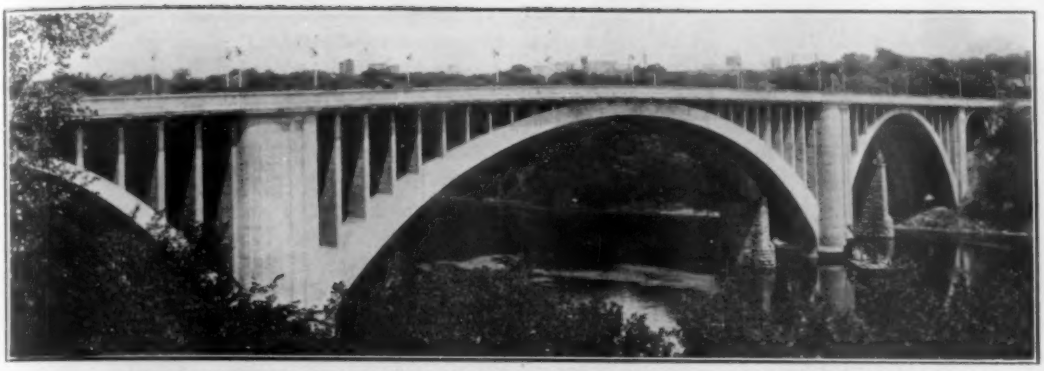
Plan of a New French Garden City

THE new garden city of Suresnes is situated partly in the commune of Suresnes and partly in that of Rueil. It is laid out upon a broad plateau with superb views of Mont Valerien, of Marly, and of the Bois de Boulogne.

When completed, Suresnes will have an area of about 75 acres and a population of some 6,000. Its 1,270 families will occupy 530 cottages and 740 apartments. The triangle which is being developed at the present time forms less than one-sixth of the whole. It contains 190 four- and five-room apartments and 13 cottages.

Around the Grande Place, or Central Square, when developed, provision will be made for shops, for a restaurant, for cooperative stores and for a festival-hall, for the post office, a police station, a hotel for unmarried men, a group of schools and numerous accessories, including a crèche and a canteen or lunchroom.

ACKNOWLEDGMENT.—For the accompanying plan THE AMERICAN CITY is indebted to Edith Elmer Wood, author of "Housing Progress in Western Europe." (E. P. Dutton & Company, New York.)



A SCENIC PICTURE OF THE GRACEFUL CAPPELEN MEMORIAL BRIDGE AT MINNEAPOLIS

Illumination of the Cappelen Memorial Bridge, Minneapolis

By F. M. Reast

THE Cappelen Memorial Bridge at Minneapolis, Minn., was opened to traffic with impressive ceremonies in December, 1923. It is said to be the largest concrete bridge in the world. Its center span is 400 feet, and each rib contains 2,300 cubic feet of concrete. Construction of the bridge was started in the latter part of 1919 from plans made by the late F. W. Cappelen, at that time city engineer, and up to the time of his death in active charge of operations. Although many engineering difficulties had to be overcome, the bridge is exceedingly simple, both in design and construction, and to-day it stands as a fitting memorial to the courage and resourcefulness of its designer, after whom it was named.

The new span reopens a direct route between the twin cities of Minneapolis and St. Paul and replaces an old structure across the Mississippi at the same place. It has already become part of an important arterial thoroughfare linking up, via Franklin Avenue, the two sides of the Mississippi and relieving a large part of the traffic congestion on Lake Street and University Avenue.

In planning the new structure of concrete, due attention was given to the surroundings and scenic value of the site, which is largely of a park and residential nature. Massive piers of simple yet dignified character support the center span and the two lesser spans of 400 feet and 199 feet respectively. The total length of the bridge is 1,010 feet, with a 40-foot roadway, and two sidewalks having a width of 8 feet each.

In selecting a lighting system for the new

THE CAPPELEN MEMORIAL BRIDGE, SHOWING LIGHTING UNITS

structure, the Minneapolis city authorities devoted considerable time to the selection of a unit that would satisfactorily light the bridge, that would be appropriate from an architectural standpoint, and economical from the standpoint both of maintenance and of operation. After a series of tests, Westinghouse octagonal Senior lanterns, equipped with Westinghouse Holophane Bi-lux refractors, were chosen. Inasmuch as trolley poles had been erected on the structure in anticipation of its use by a new street-car line, it was decided to support the lanterns by brackets on these poles, thus utilizing them for a double purpose and eliminating the necessity of erecting additional poles for the lighting units.

The Minneapolis Gas and Electric Company supplied a multiple circuit for the original 650-candle-power, 15-ampere lamps, which have been replaced by 400-candle-power lamps, as it was found that the smaller size when used with the Bi-lux refractors provided ample illumination of sidewalks and roadway. These refractors concentrate the light upon the bridge surface where it is needed, instead of allowing it to radiate in all directions. In bridge lighting, where light radiating beyond the guard-rail is totally wasted, this device has a distinct advantage.

Alderman John Peterson, Chairman of the Roads and Bridges Committee, presented the Capellen Bridge to the city. In accepting the structure, Mayor George E. Leach said, "It is the most beautiful bridge I have ever seen. This magnificent span of concrete in the splendid sweep of its long structure is indeed a monument to Mr. Cappelen. It forms an important artery in inter-city traffic. It is a worthy civic achievement." The parade which formally opened the new bridge was led by Mr. and Mrs. Arthur Cappelen in fulfillment of a request made by F. W. Cappelen before his death that his son might be the first to cross the completed span.

The Development of Sewage Treatment by the Activated Sludge Process

By Edward Bartow

Professor and Head of the Department of Chemistry, University of Iowa, Iowa City, Iowa

AIR has always played an important rôle in sewage disposal. Its earliest application was in the exposure of sewage on the ground or in shallow pools. This was followed or accompanied by use of the waste for irrigation or for fertilizing crops of various kinds. Hence disposal by irrigation is an aeration process. The amount of sewage or waste which can be added to land is limited by the amount which can be thoroughly oxidized, and disposal by irrigation is not satisfactory in wet countries. With the introduction of water carriage, sewage and wastes were carried to streams or other bodies of water where dilution took place. The disposal of sewage or wastes by dilution depends upon the amount of air present in the stream, and the efficiency of the stream as a medium for the disposal of sewage depends upon the amount of oxygen in solution or the possibility of re-aeration.

More sewage per acre can be taken care of by intermittent filtration on beds of sand than by irrigation. In intermittent filtration on beds of sand, the sewage is added intermittently to sand beds. Between the periods of flooding with sewage, air enters the open spaces between the sand grains, and aerobic organisms develop with power to consume the wastes.

The action of contact beds is similar. Coarser material is used, and between periods of flooding, air enters the interstices and is the purifying agent.

Sprinkling filters consist of beds of broken stone, coarse cinders, or other similar media over which the sewage or waste matter is sprayed in a finely divided state into the air. Here again the oxygen is the purifying agent.

The efficiency of these aeration processes is increased by preparatory treatment. Coarse suspended matter is removed by grit chambers, screens, settling tanks, digestion tanks or chemical precipitation. Preparatory treatment varies according to conditions. For example, if the waste matter is emptied into a large stream, no preparatory treatment is needed; smaller streams may require the removal of the coarse suspended matter; and the smallest streams may require settling tanks, digestion tanks, or chemical precipitation to remove the finer suspended matter and soluble putrescible matter. For the most complete purification, aeration processes are necessary.

Activated Sludge Treatment

Treatment of sewage by aeration in the presence of activated sludge is a development of the aeration process. Numerous experiments of blowing air into sewage have been made both in America and in Europe. Prior to 1911[1] Black and Phelps had blown air through sewage as it passed through a series of inclined wooden gratings. This sewage was in contact with the air for periods up to 24 hours. The results were promising enough to cause Black and Phelps to recommend the construction of a larger plant for Greater New York.

About the same time Clark, Gage, and Adams[2] were making experiments at the experimental station of the Massachusetts State Board of Health at Lawrence. Air blown through sewage reduced the organic constituents. The seeding of the sewage with green growths accelerated the action. Slabs of slate in the tanks which became covered with growths of sewage matters gave best results when air was blown in at the bottom of the tank. Sewage thus treated could be handled on sand beds at several times the normal rate.

The operation of the tanks at the Massachusetts Experiment Station was observed by Gilbert J. Fowler of Manchester, England, in November, 1912. Fowler and Mumford had been attempting to develop a specific bacillus which they named M-7 for sewage disposal. This bacillus with aeration has the power of separating iron as ferric hydroxide from iron-bearing sewages, carrying down with it the suspended matter, and furnishing a non-putrescible effluent. At Fowler's suggestion, Ardern and Lockett,[3] who were in charge of the Manchester Disposal Works, drew air through sewage by means of an ordinary filter pump. When the sewage was completely nitrified (after about five weeks) the supernatant liquid was drawn off and additional sewage added. The process was repeated several times. As the amount of deposited matter increased, the time required for each oxidation gradually diminished, and finally a well-oxidized effluent was obtained in from six to nine hours. Ardern and Lockett repeated their experiments with barrels of 50 gallons capacity and later tanks of 20,000 gallons capacity. The results were so satisfactory that additional plants have been constructed in England and Salford, and larger-scale plants at Manchester and Worcester. Other plants in which aeration has been accomplished by mechanical means have been constructed, and the process is being used almost exclusively for new construction in England.

The activated sludge process is by no means suitable for all sewage disposal problems. It will, however, be suitable where land is scarce, where water is scarce and the effluent can be used for irrigation, and where the concentrated wastes must be disposed of with but little dilution water. The process can be highly recommended for consideration wherever sewage disposal problems arise and conditions are suitable for its use.

Early American Experiments

In August, 1914, I had the privilege of meeting Professor Fowler in Manchester, England, and of seeing the work which had been done by Ardern and Lockett under his direction. On returning to this country, with the advice of Professor Fowler, and with the help of Dr. F. W. Mohlman, experiments[4] were begun at the University of Illinois. In the first experiments 3-gallon bottles were used; in the second a tank 9 inches square, 4½ feet deep, having a glass front and back so that circulation could be observed, was used. A "Filtros" plate was placed in the bottom. The third set of experiments were made in four reinforced concrete tanks, 3 feet 2 inches square and 8 feet 5 inches deep. The fourth set of experiments were made in the septic tank designed for the city of Champaign, Ill., in 1897, which was modified for the purpose.

The first experiments gave results similar to those obtained by Ardern and Lockett. The first oxidation was accomplished in 15 days, the thirty-first in 5 hours. It was found unnecessary to obtain complete oxidation before the removal of the supernatant liquid. By removing it at frequent intervals, sludge was collected and at the end of a week or 10 days oxidation of sewage could be accomplished in a few hours. The fact that sludge could be developed so quickly was considered of great importance, as a new plant could be put into operation and operated efficiently without seeding with other sludge or without waiting for the long periods of oxidation used in the first experiments.

[1]Report Concerning Location of Sewer Outlets and the Discharge of Sewage into New York Harbor, 1911, 64-78.

[2]Annual Report, Massachusetts State Board of Health, 45, 288-304 (1913).

[3]J. Soc. Chem. Ind., 33, 523-39 (1914).
J. Soc. Chem. Ind., 33, 1122-4 (1914).

[4]J. Ind. Eng. Chem., 7, 318 (1915).

Continuous Flow System

The first experiments in Europe and in America were made on the fill and draw system. It was soon found advisable to use a continuous process, and all plants of any size have been so constructed, the combined sewage and sludge flowing into a settling tank, from which the supernatant liquid flows to the sewer, and the sludge is returned to the aeration tank, except that excess of sludge is removed for disposal.

In the United States, activated sludge plants have been put into operation by the Sanitary District of Chicago at the Desplaines plant at Maywood, and at the Calumet plant south of the city. These plants each have a capacity of five million gallons, and have been in satisfactory operation since 1922.

The Sanitary District of Chicago is constructing an activated sludge plant north of the city, which will have a capacity of 175,000,000 gallons. The sludge is to be disposed of by distributing it on waste land. The city of Milwaukee has nearly completed an activated sludge plant having an average capacity of 85,000,000 gallons per day. The city of Indianapolis is constructing a plant which will have a capacity of 50,000,000 gallons per day. All these plants will obtain air by blowing it through porous plates in the bottom of tanks. The sludge and sewage will be separated in Dorr clarifiers or by some mechanical device.

In England plants have been constructed and are in operation at Manchester, Sheffield, Birmingham, Worcester, Bury, Bolton, and elsewhere. The present status of the activated sludge process in England has been described by T. Chalkley Hatton.[5] Large installations are being constructed at the present time. The principal aim of the English engineers is to reduce the amount of air required. This is being done in three ways: (1) By placing the porous plate diffusers on one side of the bottom of the aeration tanks, parallel to the lines of flow. This causes circulation of the mixed sewage and sludge and a considerable saving of air. (2) A method brought out by Haworth at Sheffield in which the mixed sewage and sludge is caused to pass through channels 6 feet wide and 4½ feet deep, in which there is a maximum of contact between the air and the liquid. (3) Aeration by a revolving disc raising the mixed waste and sewage through central cylinder and spreading it over the surface of a tank. The thoroughly aerated waste is allowed to settle, the supernatant liquid being removed, and the sludge mixed with fresh sewage and sludge at the bottom. (4) At Bradford, diffusers are made of porous concrete tile, the aggregate being a roof slag or stone passing a ¼-inch mesh. The bottom and sides are made practically air-tight by a coating on cement, the top having a width of 2 inches and having the full length of the tile unplastered and quite porous. The air enters the diffusers through a wrought-iron air pipe with ¼-inch perforations. Each end of the tile is plugged after the air pipe is placed. The advantages claimed for this diffuser are its small cost, facility of renewal, and small friction losses.

Only experimental studies with mechanical aeration devices have thus far been made in the United States. At the Desplaines plant of the Sanitary District of Chicago, an installation similar to the second process described above has been in operation for several months with promising results. An installation of the same type is to be placed at the plant of the Corn Products Refining Company at Argo, Ill., where a very concentrated organic waste has to be treated. Experimental work was carried on for several years at the Union Stock Yards at Chicago, and it was decided that the activated sludge process was the process best suited to the treatment of packing-house waste.

A small plant having a capacity of about one million gallons per day has been in operation at the packing-plant of Jacob E. Decker and Sons, Mason City, Iowa, for two years and is giving satisfactory results in the treatment of the waste from this packing-house, where hogs are slaughtered.

Dewatering Sludge

No special attempts have been made in England to dewater and dry activated sludge so that it can be satisfactorily transported for use as a fertilizer. Large quantities of organic nitrogenous matter suitable for fertilizer are wasted annually in the United States. The activated sludge is being dewatered and dried at the Calumet plant of the Sanitary District of Chicago with an Oliver filter and rotary drum dryer. At the Maywood plant of the Sanitary District of Chicago, a horizontal hydraulic press invented by J. J. Berrigan is used in connection with the rotary drum dryer. The Milwaukee Sewerage Commission is planning to use Oliver filters and rotary drum dryers.

Probably the first proof of the fertilizer value of the activated sludge was in pot cultures made at the University of Illinois in 1915. Since that time, large-scale field tests have been

[5] Engineering News-Record, 93, 538-9 (1924).

made in England, in Canada, and recently in Wisconsin by the Milwaukee Sewerage Commission, and in Illinois by the Sanitary District of Chicago. There is no doubt whatever of the fertilizer value of the activated sludge, and undoubtedly some means will be devised by which the sludge can be economically dewatered and dried.

Portland Cement Concrete Foundations for Asphalt Pavements

By W. B. Fowler
City Engineer, Memphis, Tenn.

MEMPHIS has adopted as a standard a sheet asphalt paving with a 1½-inch binder course and a 1½-inch wearing course on a 6-inch 1:3:6 mix concrete base. Being located in the extreme western part of Tennessee, Memphis is handicapped in its road building, because there are no local materials available for concrete except the sand and gravel from the Mississippi River. The soil is a sandy clay, which under excessive rolling becomes soft and spongy, but compacts and makes an ideal subgrade if not rolled to excess. Too much stress cannot be laid upon the proper preparation of the subgrade, regardless of the type of base used. If the subgrade is found to be too soft, subdrainage is constructed and wire mesh reinforcing is used. This condition is the exception. A plain 1:3:6 mix concrete is the standard type of base. If the best results are to be obtained, care must be taken to insure a thorough, uniform, concrete mixture. Only a sufficient amount of water should be used to just flush to the surface under tamping. The ordinary sloppy mixture will not give the best results.

Base concrete should not be tamped the same as a concrete wearing surface. The device used in Memphis is a 3-inch board about 5 feet long with handles at each end, used by two laborers working from curb to curb, the length of the board varying with the street. After thorough tamping, the surface is broomed, taking out the inequalities and leaving it rough enough for the asphalt top to key into it and prevent the top from slipping on the base.

In very hot weather, the concrete base should be wet thoroughly for a period of not less than seven days, to prevent too rapid setting. The time allowed for the setting of concrete is never less than seven days. Usually, allowing concrete to set for seven days does not work a hardship on the contractor, as he generally has at least a week's run ahead of the starting of the asphalt plant.

No allowance should be made for expansion in concrete bases. Various types of expansion joints have been tried in Memphis and they have proved of no benefit and are oftentimes harmful to the pavement.

Care should be taken to see that all construction joints are vertical. A sloping construction joint offers no resistance to expansion or compression and results in one section's overriding the other and causing a break in the base and a hump in the surface.

The paragraphs above outline the general specifications used in the city of Memphis, and over a period of years they have proved satisfactory. The per cent of asphalt failures due to base failure has been less than one per

A Place for Every Type of Pavement

Some criticism has been made of various classes of paving through the adoption by certain engineers of some particular standards by which other paving materials are graded and judged. Being a city engineer, W. B. Fowler, the author of this article, states that he cannot afford to do this. There is a particular use for all types of pavements and the mistake that is made is in using them in the wrong place. All road officials are more or less governed by their experiences, and if they have adopted certain standards by which other types of pavements are classed, it is because they are more familiar with one type than another, and the more familiar type is the standard. The average city cannot afford to experiment with various types of paving, but should be governed by its past experiences and profit by mistakes that have been made, and adopt as its standard the type of paving that has proved most serviceable.

cent. With this record in the use of concrete base, Memphis is unwilling to experiment with some other type with which it is not familiar and thereby insert another variable or uncertain quantity which might cause failure of the wearing surface. The only way in which failure of the wearing surface can be corrected is by the elimination of the individual cause. Memphis feels that it has eliminated some of the causes by constructing a substantial base.

The design used in the city of Memphis perhaps would not meet the requirements of a rural highway. The loading of a rural highway is different from a city street. The highway is usually narrow, being barely wide enough to accommodate two lines of travel. This places the outer wheels of both lines of travel near the outer edge of the pavement. The outer edge then becomes the weakest part of the pavement. In a city street the edge is next to the curb and is subjected to less wear than any other part, being less used, because of parked or standing vehicles.

ACKNOWLEDGMENT.—From a paper read before the Third Asphalt Paving Conference at Louisville, Ky.

Central Station Presents Cities with More Street Lighting

One Hundred and Forty-Five Hours a Year Added Without Additional Charge

MORE hours of light on the streets of municipalities in the state of New Jersey served by the Electric Department of the Public Service Electric and Gas Company, began December 1, without additional charge. In announcing the new time schedule, Vice-President John L. O'Toole said:

"The new schedule will add about 145 hours a year to the burning time of each lamp maintained by the company. The additional time during which lamps will be kept lighted varies from five to as high as fifty minutes, depending upon the time of year, and the schedule is supplemented by a company rule that requires fifteen minutes in the morning and fifteen in the evening to be added to the burning time on cloudy days.

"The schedule has been scientifically prepared in accordance with the duration of daylight, and varies, of course, with the season of the year. Under the old schedule, a change in time was made three times a month. Under the new schedule, a change will be made four times a month in order more closely to conform to daylight conditions.

"One of the reasons for the change is increased traffic congestion. The new schedule will provide light earlier in the evening and later in the morning and will constitute a safeguard against possible accidents to both pedestrians and vehicles.

"The change will add considerably to the cost of providing the service, but will be made at the expense of the company, which will not call upon the municipality to bear any part of the added cost."

At the office of the company it was said that the change had been made voluntarily in order to supply a better service and to provide the company's municipal customers with a more satisfactory and efficient system of street lighting.

International Congress of Cities to Meet in Paris

THE city of Paris having officially proposed that the Third International Congress of Cities, organized by the International Union of Cities, should be held in Paris at the time of the opening of the International Exposition of Modern Decorative and Industrial Arts, the General Council of the Union, meeting in Basle last December, accepted the invitation for September 28 to October 4, 1925. It will be remembered that the first of these Congresses was held in Ghent in 1913, and the second in Amsterdam, in June, 1924. The Third Congress will be held under the auspices of the City of Paris and the Council of the Department of the Seine. A preliminary announcement of the program has been sent out.

There will be reports of the International Union of Cities, its activities and publications and its relations with other international organizations and institutions—the League of Nations, the International Bureau of Labor, the International Red Cross, and organizations dealing with unemployment, tuberculosis, and venereal disease. Local unions of cities and communes will report on their activities. There will be a report on the results of the inquiry regarding municipal home rule, and discussions of the municipal ownership of land and its influence on the problem of housing, and also of the administrative problems that arise in city consolidation. A special invitation is extended to American municipalities to be represented at the Congress. Further information can be obtained from E. Vinck, Director, l'Union Internationale des Villes et Communes, 3bis, rue de la Regence, Brussels, Belgium.

Zoning and Platting Supervision as Fundamentals to City Planning

By Lawrence M. Orton

Of the Staff of the Regional Plan of New York and Its Environs

THE superficial objections raised by those who are ignorant of the real meaning of city planning are quite easily met by an explanation of the aims and methods of the best planning practice. Perhaps the most common criticism arises from the mistaken linking of all planning with the "City Beautiful" idea, to which is coupled the notion that city planning is a very expensive hobby and but a fancy name for authorizing raids on the public pocketbook.

An examination of the reports and work sheets of accredited city planners is the best refutation of these objections. These documents prove that the planning consultant is an essentially practical man whose recommendations are guided by the actual facts in a situation,—facts which he is better able to discover than the average individual because he is trained by long experience to recognize and evaluate data,—and that he is unbiased in his attitude. An improvement is recommended not only with a view to the ideal solution, but after a full consideration of the expense involved, the ability of the public to pay for it, and the relative importance it bears to other possible improvements. If a street widening is suggested, the cost in money is balanced against a carefully calculated cost of the failure to widen that street, in terms of congestion and dangerous street conditions. If a system of parks is proposed, it is based on a real conception of the needs of the people for recreation, open air and relief from the strain of city surroundings, and the cost of acquiring the needed park equipment at the present time is balanced against what it will cost to provide it later on. It is often the cold figures of the balance sheet which support the "visionary schemes" of the city planner.

There are other objections raised by thoughtful observers of the growth of cities, which must be answered because they challenge the efficacy of city planning as a constructive solution for the ills of the modern city. These critics admit that the widening of a bottleneck thoroughfare affords at least local and temporary relief to traffic; that parks now established are an insurance for the future health and comfort of the city dweller; but they doubt that any one can have the vision to see in a comprehensive way what will be needed in the future, and they point out that, no matter how wise the city may be in planning public property, the vast majority of the city area is privately owned, and it is the unguided and misguided private citizen who really molds the future of the city.

The Technician and the Skeptic

It is a foregone conclusion that one who undertakes to carry the gospel of city planning to the great number of towns that cluster within a metropolitan region will encounter many skeptics. The objections raised by these Doubting Thomases are of immediate importance to the field agent because they represent the layman's attitude toward city planning. The technician is likely to discuss details of procedure, but the layman inquires what there really is in this planning idea: Is it fundamental? Does it offer a constructive program for coping with the problems which beset the modern city?

This type of skeptic also points out that city plans are based on an assumed future population, and more particularly on the distribution of this population within the city area. He doubts the ability of any one to prophesy this with accuracy. He also argues that planning presupposes a classification of land by use as a basis on which to plan its physical layout and equipment. He claims that great areas of most cities are "blighted," not only because they were originally used for the wrong purpose, but because they pass from one use to another. The status to which this critic relegates city planning is about that of a glorified local improvement association.

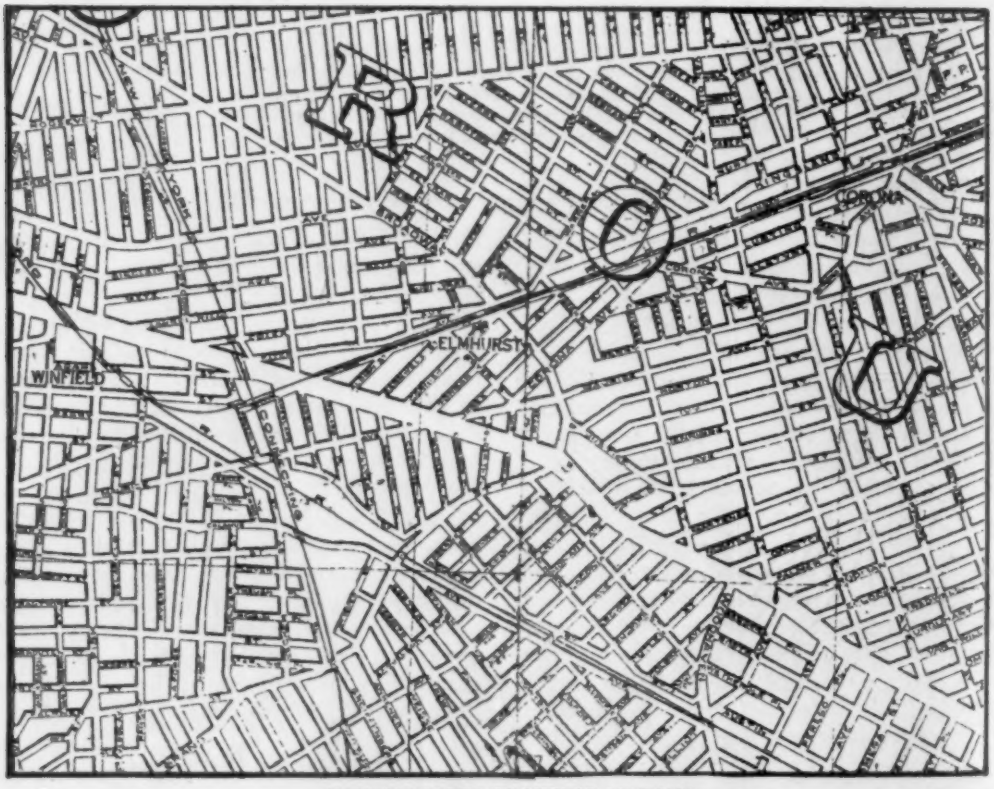
The New Era in City Building

The person who raises these objections has failed to take into account the two most constructive elements in modern city planning,

and therein lies his failure to see that a new era in city building is at hand. He does not realize that means have been discovered for utilizing the activities of private individuals toward the realization of a comprehensive plan, nor that certain protective measures make economic law a powerful force guiding the development of the city along the lines set down in the plan.

First and foremost of these constructive elements is the zoning idea—the possibility of limiting by public enactment the uses to which land shall be devoted, the height and bulk of buildings to be built thereon, and the density of population that shall be permitted. There is probably room for improvement in the technique with which the best use of land is determined, and especially in the standards of light and air which the public welfare demands shall be provided for workers and for residents; and also in the terms in which these shall be legally defined and enforced. But it now seems a certainty that public authority will be used increasingly, with proper safeguards to protect the interests of the individual, to direct the development of private land in the interest of the people as a whole.

The implications for orderly planning in this procedure are tremendous. It means that the streets, sewers, water distribution system and other physical equipment of the city can be provided with an accuracy which has never been approached heretofore. The industrial zone can have the layout and transportation facilities it needs, and, being segregated in this district, the factories will be least detrimental to the city at large. The business district can be planned to suit its own needs, which are distinct and quite different from the rest of the city. Residence districts need not suffer from the encroachment of other land uses, and can be laid out in their own particular style. Finally, the planner has some definite criteria on which to base his estimate of future population, since the population of a particular district can increase only within the limits permitted by the building density provided for in the ordinance. Calculations will be a matter of fact and not of guesswork, enabling the physical equipment of the municipality to be provided with mathematical accuracy.



UNRESTRICTED PLATTING OF LAND

A section of Queens County, New York City. The patchwork which often results when private developers have full swing. Dead-end streets, jogs, angular crossings and odd-shaped remnants of land are the result. Note the difficulty in traveling north and south across this section

Greater Stability in City Growth

Moreover, the zoning of cities not only limits the use of land, but reverses the influences which in the past have caused certain areas to shift from one use to another. It is impossible to discuss even briefly within the limits of this article the trends of city growth. However, every one is familiar with the once fine residence district that is now "down at the heel," and the sections of the city once occupied by high-class retail stores but now abandoned to all comers; also the fluctuations in land value that accompany these transitions. The story told by these sections is the costliness of lack of protection, for once an objectionable building or use has entered a choice district, investors take fright and the crash in values is but a matter of time. Given the assurance and protection afforded by a zoning ordinance, the money invested in each section will act as a stabilizing force and we may therefore look for much greater stability in city growth.

Control of Real Estate Subdivisions

Another administrative power that goes hand in hand with zoning is "platting supervision," or requiring an owner to submit his scheme for subdividing property for approval by a competent board before he is permitted to go ahead. This is the opportunity for the public to supervise the actual planning of the city as it is done by the owners of property when they decide to put it on the market. These private owners often lack either the desire or the knowledge necessary to lay out their land in conformity with a general plan, and so it happens that serious mistakes are made. A map of almost any city is all that is necessary to prove this statement.

The speculator who develops his land to squeeze out the last penny of immediate return is a poor planner for the future welfare of the city. The number of dead-end streets, those with impossible grades, the failure of streets to fit in with the through thoroughfare system, are all mistakes that the city will pay for later on. The tortuous windings through which heavy traffic is forced to go, the dangerous jogs and blind crossings we now have to contend with, are the result of unsupervised private development. Our only remedy for mistakes of the past is costly street widening and straightening. Our hope for the future is in preventing the growth of such conditions. If the private owner must submit his plan for subdivision to a public authority who will approve it only in case it conforms to the general plan for the city and measures up to acceptable standards, the building of an orderly city becomes largely a matter of administrative routine.

Important Preliminary Steps

Before it is in a position to exercise this authority, a city must take several preliminary steps. Obviously, the preparation of a city plan, including a zoning ordinance, must precede the operation of these administrative agencies. Just as it is good business to put a sound foundation under a costly building, it is an economy to spend enough money at this stage to secure the services of a thoroughly competent consultant. When a plan has been prepared, in order to realize its full value not only must a program be outlined for carrying into effect the major improvements, but care must be taken to set up the administrative machinery which will utilize to the best advantage the public authority over new land developments. Also a city planning commission of the most competent and fair-minded citizens should continue to function for the purpose of making such readjustments in the plan as may be necessary from time to time.

It is certain that the art of city planning will be continually improved. From the point of view of developing proper methods for planning local streets and thoroughfares and provision for air and sunlight, there is room for a great deal of research along both practical and scientific lines. Next in importance is the making of such information available to the persons most interested. Although the literature of city planning is growing rapidly and furnishes valuable information for bodies administering city planning laws, it is impossible for the man of affairs who sits on a planning board to steep himself in these technical books. A great opportunity lies in making planning information available in such form that it will be a practical guide to the lay bodies which must administer planning locally.

Regardless, however, of the incompleteness of the present machinery for administering them, there can be no denying the significance of the two agencies which have been designated as the most constructive developments in city planning. By enabling the city to provide with scientific accuracy its equipment of streets, of recreation and school equipment, its water and sewer system, the zoning law introduces a rationalism and an economy into city building which have never been approached heretofore. Both zoning and supervision over platting are constructive city planning measures because they correct mistakes before they are made, and minimize the amount of expensive replanning which must be done. They are the "preventive medicine" of the city planning field.

Chamber of Commerce Activities in Public Affairs

Relation of Community Surveys to Commercial Development

By John H. Cover

Director, Bureau of Research, University of Denver School of Commerce; Chairman, Department of Statistics, Denver Chamber of Commerce

MOST studies of business conditions and opportunities relative to a particular community have been post mortem. Chambers of commerce have too frequently adopted the policy of inviting all industries, regardless of size, desirability, or likelihood of success, to settle within their jurisdiction. That the result has been in large part unsuccessful is evidenced by the large number of failures of chamber-encouraged establishments; the migration of plants and branches of industries established upon rainbow promises; existence of factory districts, unplanned, unkempt, unlivable; the changing attitude of chambers toward subsidies; and, finally, the growing realization that a complete diagnosis of the community's needs and possibilities is essential to a healthy growth.

In developing its program of activities, every chamber of commerce should first jot down on its list as fundamental, a survey of business, industrial and living conditions—for no activity can be correctly charted that is not based upon a knowledge of how conditions are at present and what their trend is or should be. This survey should answer such questions as: "What is significant of our daily life in this community?"; "Why does our community grow?"; "How can its growth be guided scientifically?"

Among the few cities in the country recognizing the full possibilities of a comprehensive community survey is Denver. In 1921, through the effort of Charles Gates, of the Gates Rubber Company, and at the suggestion of Dr. G. A. Warfield, Dean of the School of Commerce, Accounts and Finance of the University of Denver, the Industrial Development Committee of the Chamber persuaded Professor Homer B. Vanderblue to obtain a leave of absence from his university work and undertake a study of conditions in Denver and Colorado with particular reference to the requirements and potentialities of certain industrial processes. In addition to these specific studies, Professor Vanderblue analyzed certain general facts about this region applicable to problems of business.

University Offers Cooperation

Last summer, following the reorganization of the Chamber, new impetus was given to the program for statistical research, and the Denver University School of Commerce offered its facilities, including the part-time services of a member of the faculty to direct the work, a group of advanced students who are interested in research, and a laboratory. The students receive credit for attending a research seminar where problems and methods are studied, and for additional time spent in gathering data and organizing and presenting findings in graphic form. The committee of the Chamber, with the research director as a member, has a comprehensive program for using the material both locally and beyond. Before presenting this phase of the program, however, it seems advisable to outline the importance and contents of the survey itself.

It is natural that every business community should further its growth by attracting to it new business and industrial establishments or branches of those already settled elsewhere; likewise, it is interested in conventions and tourist activities. Chambers of commerce are frequently sponsors of such activities, and even towns of the Main Street category appropriate relatively large funds for such promotion.

Quantity Programs Versus the Quality Concept

Unfortunately, most of these movements are based upon quantity programs, for their leaders appear to think predominantly in terms of acres of factories, millions of dollars on the pay-roll, twenty-story office buildings, thousands of miles of trackage, millionaire rows, and the influx of thousands of new residents. The quality concept—congestion of buildings, type of industrial establishment, proper traffic consignment, living conditions generally—is not so obvious, and consequently these vital conditions are left to shape themselves.

Largely because of this fallacy of thinking exclusively in quantities, much of the publicity on behalf of cities is poorly planned and ineffective. It is broadcast for a general audience, when it should be concentrated for the persuasion of a few. The most desirable kind of industry and business not having been determined in advance, a publicity trap is set for all.

As an instance, a committee of the chamber of commerce of a community numbering less than 50,000 recently was granted an appropriation to encourage the growth of industry. The committee met, infused with a desire for "action" and inspired by the size of its budget. It had no program; and although it perceived its objective, the pathway was not discernible. It decided to advertise, but did not know the tenor of its message. Without knowing what to advertise, it was difficult to direct its appeal. Consequently, two appropriations were voted. One was to erect bill-boards on the main highways and railroad approaches with the legend, "We Welcome Industry." The other appropriation purchased half-pages in two periodicals with a subscriber list exclusively of public school teachers. The first appropriation merely beclouds the scenery, while the second is at least a stroke of philanthropy.

Problems of his own business and the extent of his town's development account for the business man's failure to consciously guide his city's growth. In the small town, overdevelopment of competition is easily recognized; encroachment of industry upon residence districts may be limited by common agreement, and nuisances segregated. If there is dispute, settlement is as direct as the relationship is personal. If there is undernourishment or illness, the members of the community accept the rsponsibility of alleviation as a matter of course. In the large city, knowledge of the existence of evils is not widespread; as a result, just as the utmost efficiency of one part of the machine is futile when part is out of gear, so the community carries the burden of misfit industries, misfit business, and misfit humans.

It is obvious, then, that in order properly to advertise the community, it is first necessary to *know* the city, to recognize its needs, to acknowledge its limitations. It is wise to discourage an industry which might be temporarily prosperous but in the long run must lose out under local conditions.

Analyzing the City's Needs

Analysis of the city's needs as the basis for direction of its future growth is accomplished through the community survey. Much of the analysis is essential of physical conditions, but its affect upon the welfare of citizens and upon the rating of the city among other communities is direct.

A summary of a survey program is suggested below:

1. Purpose: to study economic and social conditions in the community and the relation of the community to its environs as the basis for determining its needs and its potentialities.

2. The scope of a survey may be divided into departments: (a) Physical; (b) Economic, Industrial and Business; (c) Social; (d) Legal.

a. *Physical*—This phase of the study deals with the topography of the region with reference to adaptability for human use. It applies to such problems as drainage, health, location of residential districts, water-supply.

b. *Economic, Industrial and Business.*—Here are included such studies as growth and character of the population; requirements for the care of the population, considered both as possible limiting factors and as requisites for the support of the estimated population of the future; transit facilities for persons and goods; zoning of districts for business, industrial and residential purposes; economic and industrial activities of the region; dependence upon adjacent territory; possibilities of expansion through old and new undertakings; needs of industries already established; availability of raw products, fuel, power and their costs; labor supply and character; possible stabilization of the building industry; scales of income; barometers of business conditions and their correlation with general trends.

c. *Social and Living Conditions.*—Housing, recreation, education, public health, and correction.

d. *Legal and Governmental.*—The right of the community in streets, parks, highways, transportation lines; power of condemnation and of regulation; relation of the state constitution, city charter and legislation to business and public welfare.

A Long but Worth-While Enterprise

It will be seen by this summary that a complete survey of a community is a comprehensive diagnosis of its present status and of its potentialities in terms of tendencies. It is an attempt to define the term "welfare." Just as a person must judge his financial status

not alone upon his income, but also upon the purchasing power of that income, so a community must look not alone to the increase of its quantity of business, but to the value of that wealth to the city as well. It is a long but profitable and certain enterprise, if managed scientifically.

This is the ultimate goal of the Statistical and Publicity Committee of the Denver Chamber of Commerce and of the officials of the Denver University School of Commerce. The work will be developed gradually and carefully over a long period of time, but with every completed phase contributing to the foundation upon which the future of the city may be built. Already conclusions have been reached regarding the development of certain mineral and argicultural fields; the trend in the retail trade, in construction, in population, in certain financial barometers. As these studies are released to the committee by the School, the program for their publication and their constructive use is automatically followed. This includes publication in local newspapers, released through press associations, printing of booklets, adaptation for speakers, construction of exhibits, motion pictures and slides, indexing for reply to inquiries, and, where the material warrants, development for magazines and trade journals.

The committee realizes the temptation which it must thwart to stray from the path of scientific procedure to the easier route of careless propaganda, but it clearly sees that should that diversion be permitted, its usefulness to the Chamber and to the city and state will end. Consequently, it has chosen to work quietly as a clearing-house and service organization to all other departments and to all citizens.

How Pana Is Financing and Building Its Community Swimming Pool

By L. S. Johnson

Executive Secretary, Association of Commerce, Pana, Ill.

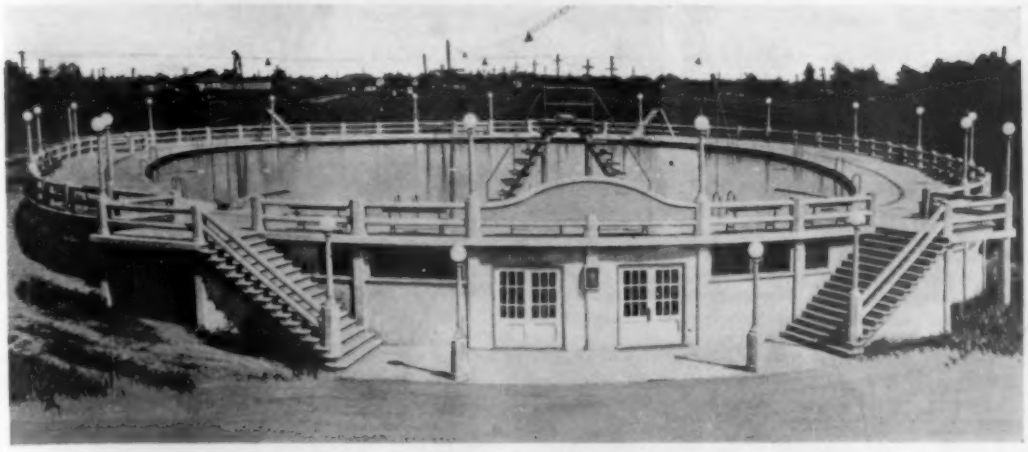
AN outdoor municipal swimming pool, of a modern and sanitary type, is now under construction in Pana, Ill., a growing city with a present population of almost 8,000. It is expected that the pool will be ready for use not later than Memorial Day this year.

When the question of financing the building of a community swimming pool was considered, the decision was made to secure the required funds through the sale of bonds in $50 denominations to the people of the community, rather than to raise the money by public subscription. The bonds are redeemable in five years and will pay 6 per cent interest during that period. This somewhat unusual plan was first tried out in this city in connection with the construction of a large auditorium for the Pana Chautauqua Association about ten years ago, and the results in that case were so satisfactory as to give reasonable assurance of success again at this time.

The Chautauqua Association issued the pool bonds, and the sales campaign was conducted by the Pana Association of Commerce. Teams were appointed to solicit subscriptions for the bonds, and the entire issue was sold in a three-day drive, some individuals investing as much as $500 each. The mortgage is being held at the bank and will be protected not only by the annual income from the Chautauqua sessions, but by the income from the swimming pool. The Chautauqua Association let the contract for the building of the pool, and that organization has assumed the responsibility for the conduct of the enterprise. The Association of Commerce will continue to handle all clerical work incident to the project.

When the campaign was staged, it was the intention of the committee in charge to erect a submerged type of swimming pool, such as may be found in many cities in this country. It was planned to give it dimensions of 200 x 100 feet, with bath-houses built separately from the pool. No provision was made for a circulating filtration system and chlorinator distributor; we were not certain that a scum gutter was required, or that a solid cement floor was a necessity. At the close of the campaign for funds, however, we awakened to the need for a thorough investigation on our part of the design and construction of modern, sanitary swimming pools, and the experience of other cities in similar undertakings. This study was made, with the result that drastic changes in our original plans were found advisable. The built-up type of pool, designed by Wesley Bintz, of Lansing, Mich., was finally adopted. It was found that this type of pool would be less expensive for us than the more common type of sunken pool, and at the same time would be finer architecturally and of more permanent construction.

The outside dimensions of the pool as now being built are 113 x 163 feet, the pool itself measuring 120 x 80 feet. The pool will have a superficial water area of nearly 8,000 square feet, with a capacity of over 240,000 gallons; a fully reinforced concrete floor with porous subdrainage layer and complete drainage system underneath; water-tight expansion joints; a pool wall reinforced with ¾-inch steel rods, spaced 3 inches apart, 12 feet high and carried 3 feet below all floors to prevent frost action; a scum gutter running around the entire pool, and a concourse floor, or walk, 16 feet 6 inches wide, of all concrete and



TYPE OF SWIMMING POOL THAT IS BEING CONSTRUCTED IN PANA, ILL.

steel construction. The pool has a depth of from 3 to 9 feet, and is 80 per cent wadeable and 100 per cent swimmable.

Some of the additional features will be a 1½-inch pipe hand-rail around the entire pool, nine concrete depth signs, eleven 1½-inch pipe ladders, a high-diving board, a spring-board, a fountain with electrical connection, and a railing 3 feet high along the outside edge of the pool, on which will be mounted seventeen lighting standards, equipped with 200-watt electric lights in white ball globes.

A bathroom floor of 5,600 square feet net area is being arranged and laid out for the installation of 800 steel lockers for men and women, 28 showers, 36 private rooms for women, with attendant showers, adequate sanitary facilities for men and women, a waiting-room, ticket office, rails and turnstiles, first-aid room, attendant's room, etc.

One of the principal features of the pool construction is the filtration system. Adequate equipment is being installed to recirculate, filter and chlorinate the water-supply daily. This comprises two 84-inch vertical filters, with 12,000 gallons capacity per hour. The pool will need to be emptied only two or three times each season.

As to the cost of the structure, the actual contract figures amount to $16,085.80. Of this sum, $2,415 represents the cost of the filtration equipment. The water-supply will be furnished gratuitously by the city, and there will be no expense involved in the purchase of land, as the pool is being erected on a suitable site within the confines of our 40-acre Kitchell Park. Allowing for contingencies, it is not likely that our complete expenditures for the enterprise will exceed $17,000.

The picture here reproduced shows the type of pool that is being constructed in Pana, and gives a very clear idea of the appearance of our structure when completed. It will be an artistic as well as a useful addition to the already attractive Kitchell Park.

Harmon Foundation Announces Play-Site Awards and New Offers for 1925

THROUGH the gift of William E. Harmon, of New York, fifty-four permanent playfields have been added to the total number of recreation places throughout the United States. About a year ago the Harmon Foundation announced through THE AMERICAN CITY, *The Playground* and the public press generally that it would expend $100,000 toward the purchase of fifty playgrounds in American communities during 1924. To be considered, it was necessary for towns making application to have a resident population of at least 3,000, and show a growth of 30 per cent or more since 1900. During the course of the offer, which closed July 1, 1924, more than 800 requests were received, coming from every state, Alaska and some of our island dependencies. After a good deal of correspondence and careful study, 88 of these applications were selected as the most promising.

In order to help the Advisory Committee in making the final selection, representatives of the Foundation made careful inspection of the first-class applications under consideration. It was found that fifty-four of these were so nearly equal in their merits that it was impossible to exclude any. Mr. Harmon, therefore, solved the problem by increasing his gift to include this full number. The Advisory Committee was:

Howard S. Braucher, Secretary, Playground and Recreation Association of America

Lee F. Hanmer, Director, Department of Recreation, Russell Sage Foundation

Owen R. Lovejoy, General Secretary, National Child Labor Committee

Chambers of commerce lead in the list of organizations initiating the applications, having ten of the fifty-four play sites chosen directly to their credit, and in a number of other cases requests came from other groups because of information supplied by the local chamber of commerce. Seven of the applications which were successful were initiated by American Legion Posts.

Others were sponsored by the Federation of Women's Clubs, Rotary, Lions, and Kiwanis Clubs, civic organizations, superintendents of schools, boards of education, mayors and private citizens interested in recreation work.

The limit of contribution for each playfield on the part of the Harmon Foundation is $2,000, and in no case was a tract of less than two acres considered. Twenty-five of the towns receiving playgrounds selected sites considerably in excess of this amount, one tract of 51 acres costing a total of $18,109. The additional funds have been supplied locally. In a number of instances land worth much more than $2,000 has been offered at that figure, the owner making the reduction as his contribution to the recreation movement. In still other cases the committees have been informed that if their town was selected the price of the land would be returned to them by the owner for development of the ground thus secured. Throughout the course of the offer it has been conspicuously evident that the average community responds generously and quickly to propositions such as this, which stimulate greater self-help.

In addition to the growth and population requirements, the conditions of the gift provide that all towns receiving Harmon Fields must guarantee a minimum development and maintenance program to extend over a period of five years. In many cases the amount required for the full five-year period will be expended during the first year. This provision was made to insure the selection of towns where continuous and constructive use of the play place would result. Before the transfer of title, which is vested in either the town council or the board of education, the sum required for the first year's development is placed on deposit.

54 Communities to Receive Harmon Playfields

The following are the fifty-four communities receiving Harmon Fields as a result of the 1924 playground gift. It will be noted that four of these are playgrounds for colored children. Thirty-one states are represented in the selection, Ohio leading with four and followed by Arkansas, Louisiana, Michigan, Minnesota, South Carolina and Tennessee with three each. Nine of the states are in the South, which sent in the greatest number of applications of any section of the country.

Alabama—Mobile (colored), Tuscaloosa.
Arkansas—Paragould, Russellville, Stuttgart.
California—Ocean Beach, Tracy.
Colorado—Alamosa.
Florida—Fort Lauderdale.
Georgia—Canton.
Idaho—Twin Falls.
Illinois—Harvey.
Indiana—Bicknell.
Kansas—Coffeyville (colored), Neodesha.
Kentucky—Madisonville, Mayfield.
Louisiana—Alexandria, DeRidder, Houma.
Maryland—Salisbury.
Michigan—Muskegon, Sturgis, St. Joseph.
Minnesota—Pipestone, West St. Paul, Worthington.
Missouri—Chaffee.
Nebraska—Kearney.
New Hampshire—Claremont.
New York—Herkimer.
North Dakota—Williston.
Ohio—Bucyrus, Fremont, Sidney, Wapakoneta.
Oklahoma—Mangum, Okmulgee.
Oregon—Bend.
Pennsylvania—Scranton, Stroudsburg.
South Carolina—Dillon, Marion, Orangeburg (colored).
Tennessee—Elizabethton, Martin, Rockwood.
Texas—Forth Worth (colored), San Antonio, Stamford.
Utah—Provo.
Vermont—Windsor.
Washington—Hillyard.
West Virginia—Point Pleasant.

An Offer of Contributions During 1925

During 1925 the Harmon Foundation plans to expend $10,000 in contributions toward the purchase of recreation sites in growing communities throughout the United States. Assistance will be rendered to the extent of 10 per cent of the cost of the land, provided that this proportion does not exceed $200, and the gift will be made in final payment of the purchase price.

The offer is restricted to towns in which the initial step in securing playground space has been inaugurated since January 1, 1925, and to those towns which applied for but failed to receive appropriations under the offer to give fifty play sites in 1924. Applications will be acted upon in order of their receipt.

To be eligible, a town must give a satisfactory evidence of growth, and show active cooperation and specific plans for the development of the playground if secured. The provision is also made that the land must be permanently dedicated for recreation use, and the deed vested in either the Town Council or the Board of Education.

No condition is made that the sites are to be known as Harmon Fields in order to receive these appropriations. However, all playgrounds so named will be entitled to participate in all competitions for awards made to Harmon Fields, or to receive maintenance allowances which may be made.

Harmon Fields May Win $10,000 in Honorariums

Distribution of $10,000 in two groups of cash awards, each totaling $5,000, will be made by the Harmon Foundation on or about March 1, 1926, to Harmon Fields which have shown the greatest progress and enthusiasm in playground development between March 1, 1925, and March 1, 1926. Any town having a Harmon playfield may qualify for an award under both types of honorarium offered:

(1) $5,000 for assistance and cooperation in the acquisition of new play sites that are dedicated permanently for recreational uses. Under this offer there is a first prize of $1,500 to the community, organization, or person responsible for the most effective program of propaganda, measured by results and interest, and other prizes ranging from $1,000 to $50.

(2) $5,000 for constructive development and use of existing Harmon Fields. Under this offer the awards range from $1,000 down to $50 each.

Full details can be secured from the Harmon Foundation, 140 Nassau Street, New York City.

The Year 1924 in Community Recreation
is the title of an important article by H. S. Braucher, Secretary, Playground and Recreation Association of America, in The Municipal Index for 1925.

Water-Supply Statistics for Municipalities of Less Than 5,000 Population—II

Statistics from 3,700 Cities Compiled for Publication in THE AMERICAN CITY and the 1925 Municipal Index—The Following Explanatory Material Is Reprinted from Our February Issue

THROUGH the cooperation of municipal water-works officials and the officers of water companies, THE AMERICAN CITY MAGAZINE is able to offer to its readers and to recipients of the 1925 Municipal Index the largest compilation of water-supply statistics that has yet been published. In order to facilitate the distribution of these statistics, all the data for cities of over 5,000 population are being published in the 1925 Municipal Index, and for cities of less than 5,000 population in THE AMERICAN CITY MAGAZINE serially, begining with February, 1925.

The tables, in which the cities are arranged alphabetically by states, show whether the water-works are owned by the municipality or by a private company. The source of supply is recorded merely as underground or surface, the former including shallow wells, deep wells, artesian wells, flowing springs, and mountain springs, and the second such sources as rivers, lakes, ponds, canals, and creeks.

The distance of the source from the city is an important matter from the fire protection standpoint as well as from the standpoint of comparison when it comes to capital investment. Storage facilities are described under three heads, namely, reservoirs, stand-pipes, and elevated tanks.

Filtration systems are divided into mechanical or American systems, slow sand filtration or the older type of filtration, and pressure filters, as applied to the mechanical filtration. In examining the entire set of reports, only chlorine and hypochlorite show as American sterilization practice to-day, with liquid chlorine by far the most common method.

In order that some idea of the total investment in pumps may be reached, the total pump capacity in million gallons daily is recorded. In some instances where low-lift pumps are used to move water from a river to a filtration plant and then high-lift pumps are used to force the filtered water through the distribution system, the total pump capacities may give an erroneous idea as to the capacity of the system. Lack of space, however, made it impossible to differentiate in these cases, as the pump capacity is recorded chiefly to show the investment in this element of the plant.

American cities are noteworthy for their excessive consumption of water. Even communities where industrial uses are not great have consumptions of 500, and some even as high as 1,000 gallons per capita. As far as possible, in these statistics domestic services are differentiated from those supplying stores, factories and industries.

Statistics are given for the number of hydrants in each city and whether they are owned by the municipality, or by the water company. The average rental per hydrant per year is given in those cases where a hydrant is charged to the water company or is credited to the account of a water department. In many cases water companies charge no hydrant rental, as such service is required in their franchises. Unfortunately, in only a few cases are water departments credited with the maintenance of the hydrants.

The average pressures for water-supplies, as well as the increased pressures for fire service, are given, as this has some bearing on the general type of pipe in use.

The following symbols are used throughout these tables to make it possible to give a greater amount of information in small space:

A —American type, rapid or mechanical filter
B —Brass pipe
C —Concrete pipe
Ch —Sterilization by liquid chlorine
Cl —Cement-lined pipe
Co —Copper pipe
F —Pressure filter
G —Galvanized iron pipe
H —Consumer or householder
Hy— Sterilization by hypochlorite
I —Cast iron pipe
K —Kalamein pipe (also Calamein and Calamine)
L —Lead pipe
Ll —Lead-lined pipe
M —Municipally owned
O —Slow sand filter
P —Owned by private company
Pp—Stand-pipe
R —Storage or distribution reservoir
Ri —Rolled iron pipe
Rv—Riveted pipe
S —Surface source of water-supply
So —Water softener
St —Steel pipe
T —Elevated tank
Tc—Terra cotta pipe
Tl —Tin-lined pipe
U —Underground source of water-supply
V —Vitrified pipe
W —Wood pipe
Wr—Wrought iron pipe

Municipality Ownership of Water works	Population	Source		Storage	Filters	Sterilized	Distribution System			Pipe Sizes Inches		Pump Capacity m. g. d.	Main Supply Metered
		Type	Aver. Miles from City				Total Miles of Main	Kind of Pipe		Mains	Services		
								Mains	Services				
GEORGIA (con.)													
Pelham.....M	2,640	U	....	.....	.....	.....	4.0	I	G	2-8	½-¾	2.6	No
Quitman.....M	4,393	U	0.3	RPp	.....	Ch	10.0	I	G	4-10	.....	2.1	...
Reynolds.....M	1,200	U	0.0	RT	No	No	1.5	I	G	8	¾	0.2	No
Rochelle.....M	1,500	U	0.0	RT	No	No	5.0	I	GI	8	¾-2	.....	No
Rockmart.....M	1,800	U	0.3	RT	No	Ch	3.0	I	G	4-10	.....	3.6	No
Royston.....M	1,800	U	0.8	RT	No	No	3.0	.....	G	.....	.....	0.1	No
Shellman.....M	1,074	U	0.0	RPp	.....	.....	5.3	I St	G	½-6	.....	.....	N
Sparks.....M	900	U	0.1	RT	No	.....	2.0	I	G	2-8	¾	1.2	No
Sparta.....M	2,500	U	1.0	RT	No	No	5.0	I	G	1-8	½-¾	.....	No
Statesboro.....M	3,807	U	....	RT	.....	.....	.....	.....	G	4-8	.....	0.5	No
Sylvania.....M	2,000	U	0.3	RPp	No	No	3.0	I	I	½-8	.....	.....	No
Sylvester.....M	1,400	U	0.0	RT	No	No	3.0	I	G	.....	2-8	0.5	Yes
Thomaston.....M	2,502	S	2.0	RPp	.....	.....	8.0	I	G	¾-10	¾	2.9	Yes
Trion.....P	2,897	S	0.5	R	No	Ch	4.0	I	G	4-8	.....	0.4	...
Vidalia.....M	2,800	U	0.3	RT	No	No	6.0	I	G	8	.....	1.1	No
Wadley.....M	1,423	U	0.3	RT	O	No	0.5	IG	G	2-6	½-¾	0.4	No
Whigham.....M	2,653	U	0.3	T	No	No	1.5	I	G	8	½	0.2	No
Willacoochee.....M	1,000	U	....	RT	No	No	1.1	I	G	4-8	½-3	1.0	No
IDAHO													
American Falls.....P	1,000	U	5.0	R	No	Ch	....	.....	G	3-8	½-¾	.....	No
Blackfoot.....M	3,937	U	0.1	PpT	No	No	23.0	I St	G	4-16	¾	1.7	No
Bonners Ferry.....M	.....	S	0.5	RT	No	No	5.0	W St	G	4-8	¾-1	1.9	No
Burke.....P	2,000	SU	1.5	T	No	No	4.0	I	G	1-6	½-8	None	No
Genesee.....M	1,000	U	0.0	R	No	No	4.0	St	G	2-8	¾	.....	No
Grangeville.....P	1,800	U	4.0	R	.....	.....	25.0	St	G	½-10	½-2	.....	No
Hailey.....P	1,550	U	5.0	R	No	.....	5.0	W	G	4-10	¾	0.3	No
Jerome.....P	2,547	U	0.0	RPp	No	No	7.0	W St	G	1-8	½	1.1	No
Lava Hot Springs.....M	1,000	U	3.0	....	No	No	2.0	I	G	2¼-4	¾	.....	No
Meridian.....M	1,000	U	0.0	T	No	No	1.5	W St	G	2-8	¾	1.6	No
Montpelier.....M	3,000	S	5.0	R	No	Ch	20.0	GW St	G	1½-4	¾	.....	No
Mullan.....P	1,667	S	1.0	R	No	No	....	I St	G	5-10	½	.....	No
Payette.....M	2,433	U	0.5	R	No	.....	15.0	W	G	4-8	.....	0.8	No
Preston.....M	3,235	....	17.0	R	.....	.....	....	W	G	4-12	¾-2	.....	No
Rexburg.....M	3,509	....	....	R	No	No	7.0	IW	.....	¾-14	.....	0.3	...
Rupert.....M	2,700	U	0.0	RT	No	....	7.0	W	G	3-10	½-1½	1.6	No
St. Anthony.....M	2,957	S	0.3	Pp	No	No	6.6	Wr W St	G	2-10	¾-2	1.7	Yes
St. Maries.....M	4,000	S	6.5	R	No	No	10.0	IW St	W	4-10	¾-2	None	No
Salmon.....M	1,365	S	1.5	R	No	No	12.0	W St	G	2-10	¾	.....	No
Sand Point.....M	2,876	S	5.0	R	No	No	29.0	W	G	2-14	½-2	None	No
Shelley.....M	1,300	U	0.0	T	No	No	7.8	IW	G	2-6	¾	0.6	No
Wardner.....P	1,000	SU	5.0	PpT	.....	.....	....	I St	.....	2-10	.....	.....	...
Weiser.....M	3,154	S	0.2	R	No	Ch	14.8	I St	G	4-16	¾-2	2.7	Yes
ILLINOIS													
Altamont.....M	1,328	U	1.0	RPpT	No	No	10.0	I	G	4-8	.....	0.1	Yes
Amboy.....M	2,645	U	0.0	RT	No	No	2.5	I	L	6-8	¾-1½	1.9	No
Antioch.....P	1,865	U	....	.....	No	No	2.0	I	L	6	¾	0.2	Yes
Arcola.....M	2,088	U	0.3	RPp	No	No	5.0	I	L	4-8	¾	0.3	Yes
Arlington.....M	284	U	0.0	T	No	No	0.8	I	G	3-6	¾	.....	No
Assumption.....M	1,852	U	4	RPpT	No	No	15	I	IG	2-4	.....	.....	No
Atkinson.....M	790	U	0.0	Pp	.....	.....	5.3	I	G Wr	6	.....	0.3	No
Atlanta.....M	1,581	U	....	Pp	.....	.....	1.5	.....	.....	1-8	.....	0.3	No
Barrington.....M	2,106	U	0.0	RPp	No	.....	7.0	I	G	4-8	¾	0.6	No
Batavia.....M	4,395	U	0.0	R	.....	.....	28.0	.....	L	4-10	.....	1.8	No
Blue Mound.....M	1,000	U	0.1	Pp	No	.....	5.0	I	WI	2-6	.....	0.9	No
Braidwood.....M	1,297	U	0.0	PpT	.....	No	2.0	I	G	4-6	.....	0.2	Yes
Breese.....M	2,399	S	2.0	R	No	No	4.0	I	GL	4-8	¾-1	2.0	No
Buda.....M	1,000	....	0.0	RPp	No	.....	2.5	.....	GL	4-10	.....	0.1	No
Byron.....M	1,000	U	0.0	T	No	.....	3.0	I	L	4-10	¾	0.4	No
Carlyle.....M	2,027	S	1.0	Pp	O	Ch	5.0	I	GL	4-8	8	1.8	No
Carmi.....M	2,667	S	0.5	Pp	No	No	7.0	I	.....	4-10	¾	10-8	No
Carpentersville.....M	1,300	U	....	RPp	No	No	6.0	I	G	4-10	.....	0.3	No
Carrollton.....M	2,020	U	4.0	PpT	.....	Ch	25	I	G	4-8	¾-4	0.6	Yes
Carterville.....M	3,404	U	2.0	RPp	O	Ch	15.0	I	G	4-8	¾-1	.....	No
Cerro Gordo.....M	2,517	U	0.0	Pp	No	.....	3.5	I	G	4-8	½-¾	0.05	No
Chatsworth.....M	1,150	U	0.1	RPp	No	No	2.0	I	GL	6-8	.....	.....	No
Chenoa.....M	2,002	U	0.1	RPpT	No	No	14.0	I	L	4-8	.....	0.2	No
Chester.....P	2,904	S	....	Pp	No	No	2.5	I	G	4-8	¾-2	1.0	No
Colfax.....M	1,000	U	0.0	RT	No	.....	2.0	I	G	4-8	.....	0.2	No
Crystal Lake.....M	2,249	U	1.5	T	.....	.....	2.5	I	IL	4-8	¾	0.2	No
Dallas City.....M	1,274	S	0.0	R	A	Ch	2.2	I	G	6-8	¾	0.2	No
Delavan.....M	1,983	U	0.0	T	.....	.....	5.0	I	L	4-6	¾-1	0.4	No

Consumption		Number of Services		Number of Meters		Per Cent Metered		Meter Rates per 1,000 Gallons		Meters Owned by	Hydrants			Average Pressure lbs. per sq. in.	
Average Daily in 1,000 gals	Per Capita	Domestic	Industrial	Domestic	Industrial	Domestic	Industrial	Max. Dom.	Min. Ind.		Number	Owned by	Aver. Rental each per year	Domestic	Fire
100	38	360	5	360	5	100	100	34¢	16¢	M	27	M	.....	45	125
700	150	600	.....	600	.....	100	.....	20¢	.....	M	55	.....	.....	65	110
65	54	185	4	None	4	.....	100	.....	15¢	.....	12	M	.....	43	43
45	30	125	.....	112	.....	90	.....	50¢	50¢	H	15	M	None	45	.....
90	50	268	8	260	8	97	100	24¢	10¢	H	None	.....	.....	82	82
35	19	.....	.....	.....	.....	.....	.....	50¢	50¢	H	24	M	None	35	45
.....	.....	150	2	150	1	100	50	60¢	20¢	MH	20	M	.....	35	75
20	22	150	.....	15	.....	10	.....	25¢	25¢	M	15	M	.....	45	100
150	60	265	6	240	6	91	100	20¢	20¢	M	41	M	None	65	150
350	94	800	10	.....	.....	.....	.....	30¢	25¢	M	80	M	.....	45	100
60	30	200	.....	200	.....	100	.....	38¢	38¢	M	25	M	.....	60	120
175	125	30	.....	24	.....	80	100	25¢	15¢	M	30	M	None	55	120
250	99	500	.....	500	.....	100	100	25¢	13¢	M	56	M	None	55	137
200	60	.....	.....	.....	.....	.....	.....	.....	.....	.....	56	P	.....	80	90
120	43	300	61	300	61	100	100	50¢	20¢	H	100	M	None	50	120
30	21	100	.....	100	.....	100	.....	.....	.....	M	8	M	.....	50	50
25	9	120	.....	None	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	30	180	.....	60	.....	33	.....	30¢	.....	M	16	M	.....	40	125
.....	.....	200	.....	.....	.....	.....	.....	.....	.....	.....	13	P	$30	65	.....
525	136	700	.....	700	.....	100	.....	28¢	28¢	H	105	M	.....	.....	.....
500	.....	470	None	None	None	.....	.....	.....	.....	.....	28	M	.....	70	90
.....	.....	269	4	None	2	.....	50	.....	.....	P	11	M	None	90	90
20	20	168	10	158	10	94	100	$1	15¢	H	36	M	None	75	150
200	11	400	50	390	25	98	50	63¢	10¢	P	37	P	$27	60	60
.....	.....	360	.....	None	.....	.....	.....	.....	.....	.....	26	M	$24	.....	57
50	20	580	5	500	5	86	100	30¢	25¢	P	23	P	$60	70	70
47	47	146	4	None	None	.....	.....	.....	.....	.....	6	M	.....	120	120
80	80	240	10	120	10	50	100	50¢	20¢	M	23	M	.....	45	47
1,000	333	500	25	3	2	1	8	10¢	5¢	M	52	M	.....	100	100
500	300	450	None	None	None	.....	.....	.....	.....	.....	21	M	$24	125	125
300	123	575	.....	575	.....	100	.....	25¢	12¢	H	70	M	.....	60	60
.....	.....	650	27	.....	1	.....	4	.....	5¢	.....	50	M	None	60	60
275	77	600	.....	50	.....	8	.....	.....	.....	H	30	M	.....	75	125
150	56	226	81	176	53	78	65	.....	.....	M	28	M	None	60	.....
150	51	430	30	None	.....	.....	.....	.....	.....	.....	17	M	.....	40	110
200	50	775	20	775	20	100	100	42¢	42¢	H	62	M	.....	55	75
480	350	345	52	.....	21	.....	40	$1	3¢	M	31	M	$10	70	70
.....	.....	1,525	20	15	20	1	100	20¢	5¢	M	76	.....	.....	60	.....
120	93	260	15	45	15	17	100	50¢	10¢	M	9	M	None	30	75
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	30	.....	.....	120	.....
300	95	700	.....	700	.....	100	.....	27¢	.....	.....	114	M	.....	65	100
35	26	40	15	40	15	100	100	$1	50¢	H	56	M	.....	60	67
100	38	200	10	200	10	100	100	35¢	12½¢	H	30	M	None	45	85
.....	.....	260	.....	260	.....	100	.....	33¢	.....	M	42	.....	.....	20	38
40	19	170	.....	170	.....	100	.....	50¢	50¢	H	47	M	.....	45	80
9	32	80	.....	None	.....	.....	.....	.....	.....	.....	18	M	.....	40	40
70	38	300	4	300	4	100	100	11¢	11¢	H	31	M	.....	52	52
16	20	102	.....	102	.....	100	.....	40¢	.....	M	44	M	.....	45	52
45	29	.....	.....	.....	.....	.....	.....	.....	.....	.....	18	.....	.....	28	28
225	107	510	10	510	10	100	100	30¢	12¢	H	105	M	.....	60	90
350	80	1,100	30	1,100	30	100	100	$1.18	20¢	H	140	M	$30	70	130
15	15	100	.....	80	.....	80	.....	40¢	.....	H	40	M	.....	40	55
20	15	48	None	None	None	.....	.....	.....	.....	.....	18	M	.....	48	48
250	104	250	.....	4	.....	2	.....	25¢	10¢	H	75	M	.....	50	80
12	12	200	2	75	.....	38	.....	50¢	.....	.....	19	M	.....	45	45
35	35	225	.....	225	.....	100	.....	40¢	9¢	.....	23	M	.....	.....	.....
750	370	300	4	300	3	100	75	30¢	10¢	M	102	M	$14.70	45	45
400	150	.....	.....	.....	.....	.....	.....	.....	.....	.....	80	M	.....	50	50
20	15	240	3	240	3	100	100	10¢	10¢	M	56	M	.....	50	85
250	124	510	.....	500	.....	98	.....	40¢	17¢	MH	62	M	.....	50	.....
.....	.....	.....	.....	.....	.....	.....	.....	65¢	.....	H	98	M	$96	57	57
40	16	300	.....	300	.....	100	.....	25¢	.....	H	41	M	.....	45	100
.....	.....	200	.....	200	.....	.....	.....	50¢	.....	H	39	M	.....	70	75
25	13	220	None	220	.....	100	.....	30¢	.....	MH	60	M	.....	60	87
45	15	100	40	None	None	.....	.....	.....	.....	.....	38	P	$52.50	60	98
35	35	142	.....	142	.....	100	.....	25¢	20¢	H	32	M	.....	50	50
25	11	1,200	.....	1,200	.....	100	.....	40¢	.....	H	71	M	.....	40	50
15	12	160	12	160	12	100	100	25¢	25¢	H	31	M	.....	72	75
75	38	369	.....	300	.....	100	.....	40¢	17¢	H	34	M	.....	40	42

Municipality Ownership of Water works	Population	Source Type	Source Aver. Miles from City	Storage	Filters	Sterilised	Distribution System Total Miles of Main	Distribution System Kind of Pipe Mains	Distribution System Kind of Pipe Services	Pipe Sizes Inches Mains	Pipe Sizes Inches Services	Pump Capacity m. g. d.	Main Supply Metered
ILL. (con.)													
Depue.....M	2,428	U	0.0	T	No	.....	4.0	I	G Wr	4–8	.....	0.2	No
Downers Grove.....M	3,543	U	....	RPp	.....	.....	18.0	.....	.....	.....	.....	1.9	No
Dwight.....M	2,255	U	0.0	RPp	.....	.....	7.0	I	G	4–8	.....	0.5	Yes
E. Dubuque.....M	1,253	U	0.0	RPpT	.....	No	3.5	I	L	4–8	.....	0.3	Yes
E. Peoria.....M	2,800	U	1.0	RPp	No	No	8.2	.....	L	4–12	1½–2	1.7	No
Elmwood.....M	1,350	U	0.0	R	.....	... .	5.0	.....	G	4–16	.....	0.2	No
El Paso.....M	1,470	U	0.5	RPpT	O	.....	2.5	I	I	4–8	.....	0.4	Yes
Fairbury.....M	2,532	U	0.3	RPp	.....	.....	3.0	I	GL	4–10	.....	.....	...
Farmer City.....M	1,860	U	0.5	Pp	No	No	3.5	I	L	4–8	.....	0.4	No
Farmington.....M	2,631	U	0.8	RPp	.....	.....	7.0	.....	GL	4–8	.....	1.2	...
Flanagan.....M	1,570	U	....	Pp	No	No	2.0	I	G	4–6	.....	0.1	No
Forrest.....M	1,000	U	0.0	RT	No	No	1.0	I	I	4–6	.....	0.2	No
Forreston.....M	1,760	U	0.0	T	No	No	3.0	I	L	4–8	¾	0.1	Yes
Freeburg.....M	2,407	S	0.4	Pp	.....	.....	2.0	I	G	4–8	.....	0.1	No
Galena.....M	4,742	U	0.3	Pp	No	No	5.5	I	L	4–10	1	.....	Yes
Geneseo.....M	3,375	U	0.5	RPp	No	.....	13.5	I	GL	4–8	¾	1.2	No
Geneva.....M	3,500	U	0.2	R	.....	.....	14.0	I	GL	4–12	.....	2.5	No
Germantown.....M	1,457	U	1.0	RT	O	.....	1.8	I	.....	6–10	.....	0.04	No
Gibson City.....M	2,234	U	0.8	RPp	No	No	6.0	I	GL	4–12	¾–3	.....	Yes
Gilman.....M	1,448	U	0.3	RPp	.....	.....	2 2	I	.....	4–8	.....	0.3	...
Glen Ellyn.....M	2,851	U	0.0	RPpT	No	.....	57.0	I	GL	4–10	¾	1.4	Yes
Grayville.....M	1,940	S	0.3	Pp	No	No	0.1	Wr	Wr	4–8	.....	1.0	No
Greenview.....M	800	U	0.3	PpT	No	No	1.0	I	G	4–6	¾	0.2	No
Hamilton.....M	1,698	S	1.0	Pp	O	Ch	5.5	I	GL	6–10	¾–2	0.8	No
Hanover.....M	1,246	U	0.0	T	No	.....	3.0	I	L	4–8	¾	0.6	No
Harvard.....M	3,294	U	0.5	RPp	.....	.....	13.0	I	L	4–12	.....	0.3	...
Hebron.....M	700	U	....	R	.....	.....	2.0	I	G	4–8	.....	0.1	No
Henry.....M	1,887	U	....	R	No	No	....	I	G	2–10	.....	0.7	No
Kansas.....M	1,000	U	0.5	PpT	No	No	3.5	I	G	4–8	.....	.....	Yes
Kenilworth.....P	1,500	S	1.0	T	F	Hy	8.0	I	L	4–6	¾–1½	0.4	Yes
Knoxville.....M	1,818	U	0.2	RT	No	No	5.0	I	L	4–10	¾	.....	No
La Grange.....P	1,050	U	0.8	RPp	No	No	25.0	.....	GL	4–16	.....	3.0	Yes
La Harpe.....M	1,949	U	0.1	Pp	....	.....	2.0	I	G	4–6	.....	0.07	No
Lake Forest.....M	3,657	S	1.5	RPpT	OA	Ch	27.0	I	IL	4–20	6	6.0	Yes
Lanark.....M	1,175	U	0.1	RPp	No	No	2.5	I	I	4–8	.....	0.2	No
Lemont.....M	2,400	S	1.5	R	No	Ch	18.0	I	G	3–10	.....	0.7	No
Lexington.....M	1,300	U	....	Pp	.....	.....	5.0	I	GL	4–8	.....	0.3	...
Lewiston.....M	2,279	U	2.5	Pp	.....	.....	7.0	I	GL	4–8	.. ....	1.0	No
Libertyville.....M	2,125	U	0.0	RPpT	No	No	8.0	I	G	4–8	6	0.05	Yes
Lockport.....M	2,684	U	....	RPp	.....	.....	10.0	I	.....	4–12	.....	0.2	No
Lombard.....M	2,044	U	....	T	No	No	11.0	I	G	4–12	.....	1.0	No
Mackinaw.....M	.....	U	0.0	R	.....	.....	3.0	I	G	4–8	¾	.....	No
Marengo.....M	1,936	U	0.5	Pp	No	No	3.3	I	L	4–8	.....	0.07	Yes
Martinsville.....M	2,373	U	0.5	No	No	No	11.0	I	G	¾–12	¾	3.0	No
Mascoutah.....M	2,343	U	0.5	RPp	O	No	2.0	I	.....	6–8	.....	0.3	Yes
Mendota.....M	3,934	U	0.3	RPp	No	No	14.0	I	L	4–8	¾	1.5	No
Metamora.....M	1,121	U	....	T	.....	.....	1.0	I	G	4–6	.....	0.4	No
Monticello.....M	2,280	U	....	R	No	No	67.0	I	I	4–8	¾–3	0.2	No
Morton.....M	1,600	U	0.0	T	No	No	3.0	I	G	4–8	.....	0.4	No
Morton Grove.....M	.....	U	0.0	RPpT	No	No	2.0	I	L	6–10	¾	1.2	No
Morris.....M	4,505	U	....	RPp	.....	.....	12.3	.....	L	4–12	.....	2.6	...
Morrison.....M	3,000	U	0.8	RPp	No	No	10.0	I	Wr	4–8	¾–2	0.7	No
Morrisonville.....M	1,200	U	....	Pp	No	.....	1.0	I	GL	4–6	¾	3.7	No
Mound City.....P	2,756	U	0.0	RPp	No	No	5.0	I	G	4–10	½	1.5	No
Mt. Pulaski.....M	1,700	U	0.2	T	No	No	5.3	I	G	4–8	¾	0.5	Yes
Mt. Sterling.....M	2,000	SU	0.0	RPp	.....	.....	3.6	.....	GL	4–8	¾–2	0.4	No
Moweaqua.....M	1,800	U	2.0	Pp	No	No	5.0	I	L	4–6	1¼	.....	Yes
Naperville.....M	4,250	U	....	RT	No	Ch	13.0	I	I	4–12	¾–4	.....	No
New Athens.....M	1,963	S	0.1	Pp	.....	.....	5.5	I	.....	4–8	.....	0.07	...
Nokomis.....M	4,000	U	0.5	PpT	No	.....	5.0	I	L	4–8	¾	0.4	Yes
Odell.....M	1,050	U	0.0	RPp	No	No	2.0	I	G	6–8	¾–1	0.4	Yes
O'Fallon.....M	2,379	U	0.5	Pp	No	No	3.0	I	G	4–8	.....	0.3	Yes
Onargo.....M	2,227	U	0.0	R	....	... ..	14.0	I	.... ..	4–6	.. ....	0.3	No
Oregon.....M	2,227	U	0.1	R	No	No	6.0	I	L	4–8	.. ....	8.0	No
Pecatonica.....M	1,087	U	0.3	Pp	No	No	3.5	I	L	4–8	¾	0.2	Yes
Pinckneyville.....M	2,649	S	1.5	Pp	.....	.....	6.0	I	G	4–10	.....	2.0	..
Plainfield.....M	1,144	U	0.0	Pp	No	No	3.5	I	L	4–8	¾	0.2	No
Plano.....M	1,627	U	....	RPp	... ..	... ..	5.0	.....	G	4–6	.....	0.2	No
Polo.....M	2,400	U	0.5	RPp	No	No	8.5	I	GL	3–8	.....	0.6	No
Princeton.....M	4,126	U	0.5	RT	No	No	15.0	I	L	4–8	¾–2	4.0	Yes
Rankin.....M	1,000	U	0.2	R	No	No	4.5	I	Wr	4–8	.....	0.5	No
Rantoul.....M	1,551	U	0.0	RT	No	No	6.0	I	G	3	.....	0.5	Yes
Riverside.....M	6,000	U	....	RPp	.....	.....	36.0	I	I	4–8	.....	1.9	Yes
Roanoke.....M	1,350	U	0.1	T	No	No	4.0	I	GL	4–8	1½–2	0.3	No
Robinson.....P	3,375	S	0.1	Pp	.....	.....	25.0	I	G	1¼–8	¾–4	2.2	Yes

Consumption		Number of Services		Number of Meters		Per Cent Metered		Meter Rates per 1,000 Gallons		Meters Owned by	Hydrants			Average Pressure lbs. per sq. in.	
Average Daily in 1,000 gals.	Per Capita	Domestic	Industrial	Domestic	Industrial	Domestic	Industrial	Max. Dom.	Min. Ind.		Number	Owned by	Aver. Rental each per year	Domestic	Fire
24	10	400	.....	400	.....	100	.....	25¢	.....	.....	40	M	.....	80	.....
100	28	1,450	.....	1,450	.....	100	.....	.....	.....	H	85	M	.....	60	225
285	127	1,200	.....	720	.....	60	.....	30¢	10¢	M	33	M	.....	44	85
5	4	136	2	128	2	94	100	15¢	15¢	H	33	.....	.....	118	118
300	107	310	44	5	47	2	100	18¢	4¢	H	87	M	26	85	85
15	11	210	50	200	3	95	6	52¢	15¢	M	27	M	.....	40	80
.....	.....	.....	.....	.....	.....	.....	.....	35¢	.....	M	38	M	.....	40	50
100	40	735	. . .	550	.....	75	.....	54¢	20¢	M	58	M	.....	45	90
75	40	320	.....	320	.....	100	100	.....	.....	.....	35	M	No	50	50
25	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	57	.....	.....	60	92
20	13	.....	.....	.....	.....	.....	.....	40¢	40¢	M	30	M	.....	38	90
300	300	80	.....	80	.....	100	.....	.....	.....	M	15	M	None	.....	150
20	11	154	30	154	30	100	100	45¢	10¢	H	22	M	.....	52	63
20	8	150	6	12	6	8	100	25¢	18¢	H	39	M	.....	50	75
400	85	600	.....	60	.....	10	.....	50¢	15¢	M	80	M	.....	70	100
120	36	1,000	6	1,000	6	100	100	35¢	20¢	M	150	M	None	55	60
25	7	800	200	900	200	100	100	47¢	20¢	H	167	M	.....	40	125
.....	.....	.....	.....	.....	.....	.....	.....	50¢	.....	.....	24	M	.....	55	55
120	54	430	3	425	3	99	100	45¢	11¢	H	39	M	.....	45	125
75	52	300	.....	350	.....	100	.....	.....	.....	.....	34	.....	.....	45	67
350	126	1,300	10	1,275	10	98	100	20¢	20¢	H	300	M	None	67	67
70	36	600	200	None	None	.....	.....	.....	.....	.....	47	M	$4.00	80	100
15	19	100	13	None	None	.....	.....	.....	.....	.....	20	M	.....	30	.....
50	29	300	.....	300	.....	100	.....	30¢	12¢	.....	64	M	.....	87	87
40	32	100	1	None	1	.....	100	.....	.....	.....	24	M	.....	70	120
150	45	800	.....	750	.....	94	.....	54¢	18¢	M	100	.....	.....	60	100
50	72	160	20	160	20	100	100	50¢	20¢	M	29	M	.....	55	90
.....	.....	550	.....	200	.....	35	.....	.....	.....	M	46	M	.....	50	100
10	10	124	.....	124	.....	100	.....	35¢	35¢	M	32	M	.....	48	65
145	97	349	None	349	None	100	.....	38¢	19¢	P	66	PM	$5	35	.....
100	55	293	None	293	None	100	.....	50¢	20¢	.....	43	M	.....	47	47
900	857	2,474	.....	2,474	.....	100	.....	.....	.....	P	418	.....	.....	50	90
35	18	116	.....	116	.....	100	.....	30¢	30¢	M	19	M	None	42	110
900	246	950	None	950	None	100	.....	21¢	.....	.....	130	M	$71	30	50
45	38	325	4	50	4	15	100	40¢	20¢	M	29	M	.....	47	86
230	96	535	.....	523	.....	98	.....	.....	.....	H	40	M	.....	80	95
50	39	192	.....	200	.....	100	.....	35¢	35¢	H	45	M	.....	50	50
200	88	612	.....	600	.....	98	.....	40¢	15¢	H	43	M	.....	47	75
.....	.....	1,000	50	1,000	50	100	100	35¢	25¢	M	65	M	.....	50	125
110	41	312	.....	312	.....	100	.....	75¢	.....	H	73	M	.....	57	100
120	59	600	None	600	None	100	None	30¢	.....	H	96	M	$10	60	60
.....	.....	175	.....	50	.....	29	.....	50¢	30¢	M	50	M	$6	55	70
.....	.....	350	.....	325	.....	96	.....	25¢	.....	M	45	M	.....	40	.....
1,500	634	1,150	20	None	None	.....	.....	.....	.....	.....	105	M	None	70	120
36	15	85	.....	85	.....	100	.....	35¢	20¢	M	33	M	.....	53	70
550	140	1,250	.....	1,250	.....	100	.....	$1	$1	H	118	M	None	45	45
8	7	20	10	20	10	100	100	40¢	40¢	M	13	M	.....	.....	40
150	67	.....	.....	.....	.....	.....	.....	33¢	16¢	H	73	M	None	60	100
30	19	400	5	300	5	75	100	67¢	67¢	H	38	M	None	56	56
50	.....	.....	6	.....	6	.....	100	25¢	23¢	H	50	M	None	65	65
350	78	1,100	.....	850	.....	77	.....	30¢	30¢	H	150	M	.....	50	125
350	117	890	10	400	10	45	100	25¢	10¢	M	110	M	None	54	125
18	15	50	.....	50	.....	100	.....	35¢	35¢	H	12	M	.....	40	40
300	113	350	9	40	9	11	100	50¢	11¢	P	37	P	.....	58	100
33	19	260	.....	274	.....	100	.....	50¢	45¢	H	39	M	.....	55	110
20	10	185	.....	185	.....	100	.....	30¢	.....	.....	45	M	.....	40	100
20	11	125	.....	125	.....	100	.....	20¢	20¢	M	21	M	.....	20	30
200	47	950	.....	950	.....	100	.....	27¢	27¢	H	137	M	.....	50	None
45	23	250	.....	.....	4	.....	.....	.....	.....	.....	32	M	$4.80	55	120
60	15	150	.....	150	.....	100	.....	40¢	10¢	H	25	M	None	53	100
30	29	175	None	175	None	100	.....	50¢	.....	H	40	M	None	45	80
25	10	135	.....	135	.....	.....	.....	40¢	40¢	M	30	M	.....	50	90
50	23	.....	.....	.....	.....	.....	.....	45¢	.....	M	200	M	.....	45	100
400	180	500	.....	500	.....	90	.....	45¢	13¢	H	80	M	.....	80	80
.....	.....	204	2	158	.....	78	.....	20¢	18¢	M	45	M	.....	48	55
500	189	500	.....	5	.....	1	.....	30¢	7¢	M	67	M	.....	80	150
45	39	295	.....	295	.....	100	.....	48¢	20¢	H	45	M	.....	42	32
90	56	610	.....	490	. ..	80	.....	.....	20¢	H	40	M	.....	45	80
175	73	675	.....	600	.....	80	.....	40¢	.....	H	58	M	None	58	75
285	67	1,450	.....	1,450	.....	100	.....	33¢	33¢	M	128	M	$10	45	100
.....	.....	45	.....	162	.....	100	.....	50¢	20¢	H	39	M	.....	70	125
200	129	.....	.....	.....	.....	.....	.....	35¢	10¢	.....	12	.....	.....	50	75
600	100	1,200	.....	1,100	.....	94	.....	20¢	.....	.....	200	M	.....	37	100
60	45	90	4	90	4	100	100	38¢	15¢	H	33	M	.....	45	87
350	104	900	128	900	128	100	100	40¢	40¢	M	75	M	$50	50	100

Municipality Ownership of Water works	Population	Source		Storage	Filters	Sterilized	Distribution System			Pipe Sizes Inches		Pump Capacity m. g. d.	Main Supply Metered
		Type	Aver. Miles from City				Total Miles of Main	Kind of Pipe		Mains	Services		
								Mains	Services				
ILL. (Cont.)													
Roodhouse.....P	2,928	U	7.0	T	No	No	5.0	I	G	4–6	.....	0.9	Yes
Rossville.....M	1,422	U	0.0	Pp	A	No	22.0	I	G	2–8	¾	.....	No
St. Charles.....M	4,099	U	0.0	RPp	No	No	25.0	I	L	4–10	⅝–4	0.1	Yes
Sandwich.....M	2,409	U	0.1	Pp	.....	.....	16.0	I	I	1½–8	¾	1.0	No
Stonington.....M	1,466	U	0.0	T	No	No	4.0	I	GL	3–6	¾–2	0.4	No
Sullivan.....M	2,532	U	0.0	T	No	No	10.0	I	I	2–8	.....	.....	No
Sycamore.....P	4,800	U	0.0	PpT	No	No	16.0	I	L	4–10	.....	1.7	Yes
Tampico.....M	1,293	U	0.1	T	A	.....	2.0	I	G	4–8	¾	0.4	No
Tiskilwa.....M	965	U	1.0	R	No	.....	2.5	.....	G	4–6	.....	None	No
Toulon.....M	1,235	U	0.0	RPp	No	No	9.0	I	L	4–6	.....	0.3	No
Trenton.....M	1,200	U	....	RPp	No	No	4.0	I	G	4–8	.....	.....	No
Utica.....M	1,275	U	0.0	RT	.....	.....	3.0	I	I	4–8	.....	0.7	...
Vandalia.....M	3,316	S	1.0	Pp	A	Ch	11.0	I	GL	4–12	.....	0.9	No
Warsaw.....M	2,031	S	0.1	Pp	.....	Ch	6.0	I	.....	4–8	.....	0.1	...
Washington.....M	2,000	U	0.0	PpT	No	No	3.0	I	.....	4–6	.....	0.4	No
Waterloo.....M	1,930	SU	2.0	....	....	Ch	4.0	I	G	4–8	.....	1.0	No
Watseka.....M	2,817	U	0.0	Pp	No	No	15.0	I	GL	4–6	½–¾	1.1	No
West Chicago.....M	3,000	U	0.0	RPp	No	No	20.0	I	L	6–8	¾	4.1	Yes
White Hall.....M	2,954	S	1.3	RPp	No	No	8.5	I	L	4–8	.....	0.4	Yes
Winchester.....M	2,732	U	1.8	T	.....	.....	8.0	I	G	4–8	¾	0.2	No
Wyoming.....M	1,506	U	....	RPp	.....	.....	6.0	I	G	4–6	.....	0.6	No
INDIANA													
Albion.....M	1,222	U	0.3	.....	No	No	2.5	I	I	4–12	.....	0.7	Yes
Alexandria.....M	4,172	U	0.3	RPp	No	No	8.0	I	GL	4–16	¾–2	3.0	No
Auburn.....M	4,800	U	0.5	R	.....	.....	14.0	I	L	4–12	¾	3.0	Yes
Batesville.....P	2,361	S	1.0	Pp	No	No	3.5	I	GL	2½–8	¾	.....	No
Berne.....M	1,800	U	0.0	RT	No	No	7.0	I	G	4–10	¾–4	0.2	No
Boonville.....M	4,551	S	....	RPp	.....	Ch	8.5	.....	G	.....	.....	1.0	...
Boswell.....M	975	U	0.8	R	A	No	6.0	I	G	3–6	.....	0.5	No
Butler.....M	1,818	U	0.0	Pp	.....	.....	4.5	I	I	4–12	.....	1.0	No
Cambridge City.....M	2,340	U	0.1	None	.....	.....	4.5	I	I	⅝–12	¾–1	2.0	No
Churubusco.....P	1,000	....	....	Pp	No	No	5.0	I	G	4	¾	0.5	...
Columbia City.....M	3,499	U	0.3	No	No	No	10.0	I	L	1–12	⅝	.....	No
Converse.....M	1,164	U	0.1	PpT	No	No	3.0	I	G	4–8	¾–1	1.2	Yes
Corydon.....M	2,000	U	1.0	R	No	Ch	5.0	I	G	4–10	.....	0.4	No
Crown Point.....M	3,232	U	0.5	RPp	.....	.....	8.5	.....	L	4–8	.....	1.5	...
Culver.....M	1,500	U	....	T	.....	.....	2.0	I	G	4–8	¾–1	1.0	No
Danville.....M	1,640	U	0.8	Pp	No	.....	8.0	I	G	1½–8	½–¾	1.0	No
Decatur.....M	4,762	U	0.3	R	No	.....	13.3	I	L	2–16	⅝	2.1	Yes
Dunkirk.....M	2,532	U	....	RT	.....	.....	10.0	I	G	4–8	¾	0.4	No
Fairmount.....M	2,155	U	0.1	R	.....	.....	4.0	I	IG	4–10	.....	0.2	Yes
Farmland.....M	1,000	U	0.1	T	No	No	3.0	I St	.....	2–8	¾	.....	...
Flora.....P	1,400	U	....	RT	No	.....	6.0	I	L	4–10	¾	.....	No
Fort Branch.....M	1,500	U	0.5	T	....	.....	5.0	I	G	6	¾	.....	No
Franklin.....P	4,909	U	0.0	RPp	No	.....	30.0	I	G	4–12	¾–4	2.0	...
Garrett.....M	4,796	U	0.3	R	No	No	9.3	I	L	4–12	¾–2	2.0	No
Goodland.....M	1,120	U	0.0	R	No	No	6.0	I	L	2–6	¾	0.5	No
Greenfield.....M	4,168	U	0.5	RPp	.....	.....	10.0	I	LI	1¼–12	¾	2.8	...
Greentown.....P	1,166	U	0.5	T	No	.....	4.0	St	G	3	¾	0.1	Yes
Greenwood.....P	2,000	U	0.1	.....	No	.....	5.4	I	G	4–12	¾–1	.....	No
Hebron.....M	1,000	U	0.0	RT	No	.....	7.5	I	I	4–8	.....	.....	No
Hobart.....M	3,450	S	....	RPp	.....	.....	5.0	I	.....	4–8	.....	0.5	...
Jonesboro.....P	1,429	U	1.0	No	No	No	4.0	I	G	4–10	¾–1½	.....	Yes
Kentland.....M	1,400	U	....	RPp	No	.....	5.0	I	G	4–8	.....	1.2	No
Knightstown.....M	2,008	U	0.5	RPp	No	No	7.0	I	G	4–12	¾–2	2.0	Yes
Ladoga.....M	1,148	U	0.1	PpT	No	No	2.0	I Wr	Wr	4–6	¾–2	0.6	...
Lawrenceburg.....P	3,466	U	0.0	RPp	.....	No	5.0	I	.....	½	.....	.....	No
Liberty.....M	1,292	U	0.2	RPp	No	Ch	4.0	.....	G	4–8	.....	0.5	No
Middletown.....M	1,174	U	0.5	R	.....	.....	5.0	I	G	4–10	.....	0.2	...
Milford.....M	1,567	U	0.0	Pp	No	No	2.3	I	I	4–8	.....	0.4	No
Miller.....M	1,000	S	4.0	PpT	.....	.....	2.0	I	.....	6–8	⅝–1	.....	...
Monon.....M	1,357	U	0.0	T	No	No	4.8	I St	G	2–8	¾–1	.....	Yes
Monticello.....M	2,536	U	0.2	Pp	.....	.....	6.5	I	LI	4–10	½–2	1.0	No
Nappanee.....P	2,678	U	0.0	Pp	.....	.....	7.0	I	G	4–8	.....	0.7	No
New Harmony.....P	1,000	U	0.0	RT	No	No	0.3	I	.....	¾–3	.....	.....	...
New Haven.....M	1,038	U	0.3	No	No	No	7.5	I	L	4–8	⅝–2	0.7	No
Noblesville.....P	4,758	U	0.1	R	.....	.....	13.0	I	G	4–12	¾–2	3.0	No
N. Manchester.....M	2,711	U	0.3	RPp	No	No	6.5	I	G	4–10	.....	2.2	Yes
N. Vernon.....M	3,800	S	0.3	RPp	No	Ch	8.0	I	GL	4–10	¾–4	4.6	No
Oakland City.....P	3,000	S	0.8	Pp	.....	.....	5.5	I	G	6–10	.....	2.0	No
Oxford.....M	1,010	U	0.2	R	No	No	3.5	I	G	1½–10	½–2	1.5	No
Paoli.....M	2,500	S	0.3	R	A	.....	6.0	I St	G	1½–6	¾–3	0.7	No

Consumption		Number of Services		Number of Meters		Per Cent Metered		Meter Rates per 1,000 Gallons		Meters Owned by	Hydrants			Average Pressure lbs. per sq. in.	
Average Daily in 1,000 gals.	Per Capita	Domestic	Industrial	Domestic	Industrial	Domestic	Industrial	Max. Dom.	Min. Ind.		Number	Owned by	Aver. Rental each per year	Domestic	Fire
100	34	375	2	374	2	99	100	50¢	17¢	M	30	M	None	.....	45
.....	.....	.....	2	.....	2	100	100	40¢	40¢	H	22	M	.....	40	80
300	73	750	.....	750	.....	100	.....	.....	.....	H	140	M	.....	72	150
180	75	780	.....	775	.....	99	.....	30¢	25¢	H	75	M	.....	40	95
250	170	80	40	80	40	100	100	30¢	30¢	M	12	M	None	44	150
.....	.....	250	40	180	32	72	80	40¢	40¢	H	42	M	.....	20	50
460	96	1,150	.....	1,025	.....	89	.....	44¢	11¢	M	135	M	.....	57	57
30	23	60	1	52	1	87	100	35¢	15¢	H	24	M	.....	50	100
.....	.....	160	None	160	None	100	.....	33¢	.....	H	25	.....	None	44	150
40	33	237	.....	237	.....	100	.....	45¢	.....	.....	54	M	.....	40	40
20	17	100	.....	100	.....	100	.....	50¢	.....	H	19	M	.....	40	60
30	24	230	None	None	None	.....	.....	.....	.....	.....	44	M	.....	60	60
200	61	475	25	475	25	100	100	50¢	8¢	M	70	M	.....	55	75
60	30	.....	.....	.....	.....	.....	.....	.....	.....	.....	57	.....	.....	60	150
.....	.....	650	.....	500	.....	77	.....	35¢	35¢	H	47	M	.....	50	225
1,200	622	.....	.....	.....	.....	.....	.....	.....	10¢	.....	37	M	.....	80	150
400	142	780	.....	750	.....	98	.....	30¢	.....	M	75	M	$6	50	50
250	83	748	3	748	3	100	100	31¢	15¢	M	115	M	None	52	52
150	51	365	5	365	5	100	100	25¢	6¢	H	102	M	.....	43	43
18	7	236	.....	.....	.....	.....	.....	.....	.....	M	43	M	.....	47	47
50	33	400	.....	300	.....	.....	.....	35¢	15¢	.....	54	M	.....	34	80
60	40	285	.....	285	.....	100	.....	35¢	26¢	H	28	M	$51.55	75	120
360	86	700	.....	135	9	19	.....	20¢	6¢	M	98	M	$30	50	110
650	135	980	60	490	24	50	40	25¢	10¢	M	123	M	$20	45	75
40	17	127	.....	17	.....	13	.....	30¢	9¢	P	66	M	.....	40	120
30	17	30	1	30	1	100	100	30¢	15¢	M	60	M	$75	52	80
300	66	1,120	.....	15	.....	13	.....	25¢	10¢	.....	75	M	$45	75	100
14	14	124	37	124	37	100	100	40¢	40¢	M	40	M	$50	55	90
.....	.....	342	.....	300	.....	88	.....	40¢	15¢	.....	55	M	$45	50	100
.....	.....	385	15	350	15	91	100	25¢	25¢	M	49	M	$48	55	120
100	100	40	5	.....	.....	.....	.....	40¢	40¢	P	34	P	.....	40	40
390	112	1,098	35	473	35	43	100	30¢	8¢	M	112	M	$30	60	90
20	17	225	.....	15	2	7	.....	25¢	8¢	M	35	M	.....	35	125
180	90	400	45	.....	10	.....	40	.....	.....	M	43	M	None	80	80
750	231	200	.....	20	.....	10	.....	15¢	6¢	M	85	.....	.....	35	60
.....	.....	385	28	385	28	100	100	35¢	25¢	M	28	M	$53.50	60	120
137	84	1,200	.....	200	.....	17	.....	25¢	8¢	M	50	M	None	80	120
299	63	1,073	.....	1,007	.....	94	.....	45¢	20¢	M	119	M	$60	37	73
90	36	650	4	640	.....	98	.....	40¢	10¢	M	63	M	$25.40	40	125
200	93	640	.....	2	32	1	.....	20¢	11¢	M	47	M	$30	45	90
.....	.....	75	.....	75	.....	100	.....	25¢	.....	M	22	M	.....	65	65
25	18	255	.....	250	.....	98	.....	50¢	20¢	P	37	P	$60	50	100
35	23	267	3	170	3	64	100	30¢	10¢	M	28	P	$50	53	53
300	61	1,800	.....	65	.....	36	.....	63¢	50¢	P	118	P	.....	40	100
400	84	1,000	3	679	2	68	66	25¢	10¢	M	63	M	.....	50	55
40	36	225	5	214	5	95	100	25¢	25¢	M	38	M	$25	55	55
340	82	1,200	.....	800	15	67	.....	20¢	11¢	.....	105	M	.....	55	95
50	43	240	.....	None	.....	.....	.....	.....	.....	.....	5	M	.....	40	85
80	40	400	33	400	33	100	100	$2.25	$1.13	P	64	P	$42.50	38	105
.....	.....	142	.....	142	.....	100	.....	25¢	25¢	H	63	M	.....	60	90
300	87	300	.....	10	.....	3	.....	.....	.....	.....	40	.....	.....	50	.....
23	16	240	25	240	25	100	100	30¢	.....	P	36	P	$50	35	70
80	57	400	.....	400	.....	100	.....	54¢	.....	H	34	M	$30	50	107
170	85	648	5	648	5	100	100	25¢	8¢	M	65	M	.....	60	115
.....	.....	180	.....	180	.....	100	.....	40¢	30¢	M	26	M	$42	70	70
.....	.....	125	None	None	.....	.....	.....	.....	.....	.....	17	M	None	.....	.....
85	66	385	.....	385	.....	100	.....	25¢	15¢	M	55	M	$30	45	112
120	102	265	.....	30	.....	11	.....	20¢	14¢	M	40	M	$60	40	80
.....	.....	224	4	224	4	100	100	20¢	10¢	M	21	M	.....	30	55
40	40	200	.....	200	.....	100	.....	.....	.....	M	20	M	$40	60	105
30	22	75	1	75	2	100	100	35¢	10¢	H	22	M	.....	55	120
.....	.....	290	.....	15	.....	5	.....	20¢	7¢	.....	55	M	.....	38	60
42	10	561	.....	560	.....	100	100	20¢	.....	H	64	P	$50	47	47
6	6	30	.....	None	.....	.....	.....	.....	.....	.....	None	.....	.....	50	60
.....	.....	250	4	115	3	46	75	25¢	7¢	M	35	M	$25	33	90
455	95	800	.....	100	.....	13	.....	25¢	9¢	P	113	P	$50	45	100
195	72	725	34	660	29	91	85	20¢	10¢	M	75	M	$40	48	197
450	118	500	30	400	30	80	100	30¢	6¢	M	85	M	$45	30	90
180	60	550	.....	11	.....	2	.....	30¢	10¢	M	40	.....	.....	60	90
.....	.....	270	30	1	2	1	7	40¢	40¢	H	39	M	$50	60	100
144	88	330	20	230	20	70	100	50¢	7¢	M	34	M	$20	65	85

Municipality Ownership of Water works	Population	Source Type	Source Aver. Miles from City	Storage	Filters	Sterilized	Distribution System Total Miles of Main	Distribution System Kind of Pipe Mains	Distribution System Kind of Pipe Services	Pipe Sizes Inches Mains	Pipe Sizes Inches Services	Pump Capacity m. g. d.	Main Supply Metered
(INDIANA Cont.)													
Parker City.....M	1,000	U	0.0	PpT	No	No	2.4	St	.....	2	.....	0.01	...
Red Key.....M	1,714	U	0.0	RT	No	No	4.0	I	G	4-8	¾-2	0.1	No
Ridgeville.....P	1,150	U	0.0	No	No	No	5.0	I St	G	2-6	.....	0.6	No
Rochester.....M	3,720	S	1.0	Pp	No	No	23.0	I	GL	4-12	.....	2.9	No
Rockport.....P	2,581	U	0.8	RPpT	No	No	6.5	I	G	4-10	¾	2.5	No
Salem.....M	2,836	U	1.0	R	O	.....	6.1	.....	Wr	4-8	.....	0.1	No
Sheridan.....P	1,768	U	0.1	RT	No	Ch	5.0	I	GL	4-8	¾-2	0.8	No
Shirley.....M	800	U	....	T	No	No	2.0	I	G	2-6	½	.....	No
Shoals.....M	1,200	SU	0.0	R	No	No	5.0	I	G	6	½-1½	0.2	No
S. Whitley.....M	1,176	U	....	.....	.....	.....	8.0	.....	L	4-6	.....	0.5	...
Summitville.....P	1,387	U	0.0	No	No	.....	3.0	I	G	4-8	.....	0.2	Yes
Syracuse.....M	1,379	U	0.0	Pp	No	Hy	4.0	.....	GL	2-8	¾	1.0	No
Tell City.....P	4,086	U	0.3	RT	No	No	7.0	I	G	4-10	.....	0.4	No
Thorntown.....M	1,508	U	0.0	RPp	No	.....	3.4	.....	G	4-8	1¼	.....	No
Upland.....M	1,080	U	0.0	T	No	No	3.0	I St	G	1-10	¾	0.3	No
Van Buren.....M	1,000	U	0.0	.....	No	No	2.0	I	G	2-8	¾-1	.....	No
Veedersburg.....M	1,800	U	0.0	Pp	.....	.....	5.0	.....	G	4-8	.....	.....	No
Vevay.....M	1,256	S	0.3	R	.....	.....	4.0	I	G	4-8	.....	1.0	No
Walkerton.....M	1,003	U	0.1	Pp	.....	.....	3.5	.....	G	4-6	.....	0.5	Yes
Warren.....M	1,689	U	0.2	None	.....	.....	5.0	I	G	4-6	.....	0.3	Yes
W. Terre Haute.....M	4,000	U	0.0	R	No	No	5.5	I	G	4-10	¾	0.9	No
Williamsport.....M	1,243	U	0.5	RPp	No	.....	10.0	I	G	4-8	¾-2	1.2	No
Winchester.....P	4,021	U	0.5	.....	.....	.....	10.0	I	GL	4-12	.....	1.5	...
Wolcott.....P	.....	S	0.8	R	O	.....	6.8	IW	G	1¼-6	.....	.....	No
IOWA													
Ackley.....M	1,529	U	0.0	T	No	No	5.0	I	GL	4-8	.....	0.4	No
Adel.....M	1,800	S	0.5	Pp	A	Ch	4.5	I	.....	4-6	.....	0.1	...
Alden.....M	840	U	0.0	T	No	.....	2.5	I	LG	4-6	¾	.....	No
Algona.....M	3,724	U	0.0	RPp	No	No	8.5	.....	Wr L	2-8	.....	0.2	No
Anamosa.....M	3,150	U	0.5	R	No	No	3.0	I	G	4-6	.....	0.8	No
Arthur.....M	.....	U	0.5	Pp	.....	.....	4.0	I	I	4-6	.....	0.4	No
Avoca.....M	1,520	U	1.0	T	.....	Ch	5.0	I	GL	4-8	.....	0.8	No
Belle Plaine.....M	3,887	U	2.0	RPp	No	No	12.0	I	G	4-10	¾	7.2	...
Bellevue.....M	1,665	U	0.3	R	.....	Ch	3.5	I	G	4-8	¾-2	0.8	...
Belmond.....M	1,797	U	0.5	T	No	No	5.5	I	GL	4-8	⅝-¾	0.5	No
Bloomfield.....M	2,065	U	0.0	RT	No	No	4.0	I	L	4-6	½-2	1.3	No
Brighton.....M	1,023	U	0.0	T	No	No	5.0	I	G	2-8	⅝	.....	No
Britt.....M	1,800	U	0.1	Pp	.....	.....	2.3	I	G	4-8	.....	0.7	No
Brooklyn.....M	1,233	U	0.1	PpT	No	Ch	2.5	I	G	4-8	¾	0.2	No
Cascade.....M	1,268	U	0.2	Pp	.....	Ch	1.3	I	.....	4-8	.....	0.3	No
Charter Oak.....M	750	U	0.2	R	No	No	3.5	I	.....	2-6	.....	0.4	No
Clarinda.....M	4,511	S	3.0	RPp	A	Ch	20.0	I	GL	4-12	½-4	3.0	No
Clarion.....M	2,826	U	0.0	PpT	No	No	6.9	I	I	4-10	.....	1.0	Yes
Clarksville.....M	1,000	U	0.1	T	No	.....	1.2	I	G	4-8	.....	.....	No
Clear Lake.....M	2,804	S	0.0	Pp	A	.....	5.6	I St	G	4-8	¾	0.8	No
Colfax.....M	2,504	U	....	Pp	.....	.....	3.5	I	.....	4-8	.....	0.5	...
Coon Rapids.....M	1,084	U	0.1	T	.....	.....	2.5	I	.....	6	.....	0.02	No
Corning.....M	2,000	S	1.0	T	No	Ch	4.5	I	G	4-6	½-2	0.9	Yes
Correctionville.....M	1,000	U	0.3	T	No	No	2.0	I	G	4-8	¾	.....	No
Corydon.....M	2,373	S	1.0	RT	O	Ch	11.0	I	G	4-8	.....	0.8	...
Cresco.....M	3,300	U	0.0	RT	No	Ch	6.0	I	G	4-12	½-1	1.2	No
Decorah.....M	4,039	U	....	R	No	No	5.0	.....	.....	4-8	.....	1.0	Yes
Denison.....M	4,000	U	0.5	RPp	No	.....	18.0	I	G	4-8	¾-1	0.9	No
De Witt.....M	1,824	U	0.0	Pp	.....	.....	2.0	.....	G	4-8	.....	0.6	Yes
Duncombe.....M	418	U	....	.....	.....	.....	1.0	.....	.....	4-6	.....	0.04	No
Dyersville.....M	2,000	U	0.0	T	No	.....	5.0	I	GL	4-8	.....	0.7	No
Eagle Grove.....M	4,433	U	....	Pp	.....	.....	8.0	I	L	4-12	.....	1.4	No
Eldon.....M	2,091	U	0.3	R	.....	.....	3.0	I	G	4-8	¾	0.3	No
Elkader.....M	1,250	U	0.3	RPp	No	No	5.0	I	G	4-8	⅝-1	0.1	No
Farley.....	1,000	U	....	T	.....	.....	0.8	I	G	4-6	¾	0.07	Yes
Fonda.....M	1,000	U	0.0	Pp	.....	.....	3.0	I	Wr	4-8	.....	0.1	...
Fontanelle.....M	1,000	U	0.3	T	No	.....	2.5	I	.....	4-6	.....	0.4	No
Garner.....M	1,500	U	....	T	No	.....	3.0	I	G	4	¾-1	.....	No
Glidden.....M	917	U	0.3	.....	No	No	1.4	I	Wr	4-6	¾-1	.....	No
Gowrie.....M	1,000	U	0.1	T	No	.....	2.0	I	G	4-8	.....	0.06	No
Greenfield.....M	1,759	U	2.0	T	.....	.....	8.0	I	G	8	¾	0.2	No
Guthrie Center.....M	2,000	U	0.0	Pp	No	No	4.0	I St	G	1-6	¾	1.5	Yes
Hamburg.....M	2,200	U	0.3	R	No	No	3.0	I	G	4-6	.....	0.2	No
Hartley.....M	1,765	U	0.1	Pp	No	No	1.5	I	GL	6-8	.....	0.04	No
Howarden.....M	2,491	U	....	T	.....	.....	3.5	I	GL	.....	.....	1.0	No
Holstein.....M	1,300	U	....	RPp	.....	.....	2.8	.....	.....	4-6	.....	0.07	....
Humboldt.....M	2,232	U	0.5	RPp	No	No	4.5	I	G	4-8	¾-1	1.5	No
Humeston.....M	1,214	S	2.0	T	No	... .	4.0	I	.....	4-6	4	0.3	No
Jewell Junction.....M	1,000	U	....	R	.....	.....	0.1	I	GL	4-6	.....	.....	No
Ida Grove.....M	2,020	U	1.0	Pp	.....	.....	12.0	.....	.....	4-6	.....	0.2	...

Consumption		Number of Services		Number of Meters		Per Cent Metered		Meter Rates per 1,000 Gallons		Meters Owned by	Hydrants			Average Pressure lbs. per sq. in.	
Average Daily in 1,000 gals.	Per Capita	Domestic	Industrial	Domestic	Industrial	Domestic	Industrial	Max. Dom.	Min. Ind.		Number	Owned by	Aver. Rental each per year	Domestic	Fire
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23	.....	.....	72	.....
10	6	325	2	30	2	9	100	25¢	25¢	M	38	M	$50	60	.....
.....	.....	25	.....	.....	.....	.....	.....	35¢	10¢	M	30	P	$50	50	100
400	107	900	.....	900	.....	100	.....	20¢	5¢	M	103	M	$25	45	120
250	97	550	.....	.....	.....	.....	.....	35¢	12½¢	P	37	P	$65	55	95
60	21	650	.....	.....	40	.....	.....	50¢	9¢	H	36	M	.....	45	60
90	51	200	63	200	63	100	100	35¢	25¢	P	53	P	$55	40	.....
.....	.....	160	.....	160	.....	100	.....	25¢	.....	M	14	M	.....	40	40
45	38	85	20	30	20	35	100	60¢	25¢	MH	19	M	$60	60	60
.....	.....	275	.....	15	.....	5	.....	30¢	6¢	M	46	.....	.....	60	100
185	133	300	3	None	3	.....	100	.....	8¢	P	25	P	$65	35	90
150	109	285	3	None	.....	.....	.....	.....	.....	.....	26	M	$60	38	100
250	61	460	30	320	30	70	100	.....	.....	P	83	P	.....	80	100
70	46	170	.....	3	.....	2	.....	30¢	10¢	M	42	M	.....	35	.....
55	51	170	7	23	7	13	100	35¢	12¢	M	27	M	None	68	68
.....	.....	185	5	.....	5	.....	100	20¢	14¢	M	15	M	None	35	100
60	33	300	25	180	25	60	100	33¢	12¢	M	20	M	.....	50	100
75	60	240	5	10	5	4	100	25¢	25¢	H	38	M	.....	80	80
60	60	200	.....	100	.....	50	.....	25¢	.....	M	23	M	.....	50	50
.....	.....	500	.....	315	.....	63	.....	20¢	.....	M	42	.....	$40	70	150
180	45	300	.....	85	.....	28	.....	25¢	25¢	M	52	M	$40	50	87
60	48	400	.....	135	.....	34	.....	40¢	.....	H	40	M	$30	60	120
.....	.....	868	.....	613	.....	71	.....	25¢	7¢	P	70	.....	$50	45	100
.....	.....	185	15	185	15	100	100	25¢	25¢	M	24	M	None	67	67
40	36	210	.....	210	.....	100	.....	45¢	20¢	H	34	M	None	47	120
34	19	.....	.....	.....	.....	.....	.....	.....	.....	MH	39	M	.....	40	40
.....	.....	137	.....	137	.....	100	.....	50¢	25¢	MH	34	M	.....	52	52
110	30	812	.....	795	.....	98	.....	40¢	20¢	H	32	.....	.....	45	45
60	19	420	.....	360	.....	86	.....	40¢	13¢	M	15	M	.....	38	130
25	.....	70	.....	65	.....	93	.....	25¢	.....	M	15	M	.....	70	70
60	40	450	25	450	25	100	100	50¢	.....	H	44	M	None	68	90
140	37	655	15	614	5	94	33	40¢	20¢	M	60	M	.....	75	75
75	45	384	.....	346	.....	90	.....	35¢	15¢	MH	32	M	$43.75	100	100
28	16	276	.....	276	.....	100	.....	40¢	20¢	H	40	M	.....	40	80
100	48	250	2	250	2	100	100	40¢	10¢	M	63	M	None	45	63
.....	.....	65	2	65	2	100	100	65¢	25¢	H	40	M	.....	.....	.....
150	84	250	.....	None	.....	.....	.....	.....	.....	.....	19	M	.....	30	100
100	81	154	.....	150	.....	98	.....	.....	.....	H	17	M	None	60	80
.....	.....	250	.....	25	.....	10	.....	25¢	25¢	M	75	M	.....	84	84
45	60	250	.....	None	.....	.....	.....	.....	.....	.....	22	M	None	70	90
300	67	1,029	17	1,024	17	99	100	33¢	10¢	M	104	M	None	50	200
40	14	540	10	540	10	100	100	40¢	8¢	H	64	M	.....	50	75
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	21	M	.....	50	.....
70	25	1,015	1	1,015	1	100	100	40¢	.....	H	53	M	None	38	125
90	36	400	.....	21	.....	5	.....	30¢	10¢	MH	25	M	.....	100	100
.....	.....	125	10	80	10	64	100	40¢	.....	H	14	M	.....	52	52
70	35	450	None	435	None	97	.....	40¢	.....	H	39	M	None	60	83
30	30	140	1	126	1	90	100	25¢	10¢	H	15	M	None	110	110
80	34	300	.....	300	.....	100	.....	40¢	30¢	H	54	M	None	48	48
85	26	490	9	490	9	100	100	45¢	40¢	H	60	M	None	45	110
.....	.....	800	.....	750	.....	94	.....	31¢	8¢	.....	55	.....	.....	90	110
500	125	1,600	.....	1,600	.....	100	.....	50¢	20¢	H	80	M	.....	105	105
100	55	400	2	160	2	40	100	20¢	20¢	M	59	M	None	35	45
3	7	.....	.....	None	.....	.....	.....	.....	.....	.....	13	M	.....	60	70
100	50	350	.....	350	.....	100	.....	25¢	15¢	M	40	M	.....	65	95
125	28	800	.....	750	.....	94	.....	30¢	9¢	M	80	M	.....	40	100
25	12	220	.....	150	.....	68	.....	30¢	15¢	M	31	M	.....	65	65
75	60	334	6	305	6	91	100	40¢	15¢	M	41	M	.....	105	105
2	2	104	None	103	None	99	.....	30¢	.....	H	16	M	.....	40	40
.....	.....	101	.....	101	.....	100	.....	50¢	40¢	H	15	M	.....	42	100
.....	.....	30	5	30	5	100	100	80¢	80¢	M	32	M	.....	40	40
40	27	300	.....	210	.....	70	.....	40¢	.....	M	44	M	No	35	80
.....	.....	250	None	250	None	100	.....	60¢	.....	.....	18	M	None	50	50
2	2	120	10	130	.....	100	.....	40¢	.....	H	23	M	None	50	.....
100	57	350	.....	350	.....	100	.....	$1.75	35¢	M	35	M	.....	75	75
150	75	400	50	None	36	.....	72	.....	30¢	M	50	M	.....	65	100
50	23	242	.....	242	.....	100	.....	50¢	20¢	H	36	M	None	80	80
10	6	23	15	23	15	100	100	50¢	.....	H	11	M	.....	40	40
75	30	350	.....	350	5	100	.....	47¢	.....	M	25	M	.....	95	95
.....	.....	52	.....	.....	.....	.....	.....	.....	.....	.....	42	.....	.....	45	120
90	40	425	4	425	4	100	100	40¢	10¢	H	33	M	None	50	90
85	70	72	4	72	4	100	100	40¢	15¢	M	27	M	.....	43	43
1	1	.....	.....	60	.....	.....	.....	30¢	.....	H	13	M	None	60	80
75	37	300	.....	300	.....	100	.....	.....	.....	.....	48	.....	.....	75	80

Municipality Ownership of Water works	Population	Source Type	Source Aver. Miles from City	Storage	Filters	Sterilized	Distribution System Total Miles of Main	Distribution System Kind of Pipe Mains	Distribution System Kind of Pipe Services	Pipe Sizes Inches Mains	Pipe Sizes Inches Services	Pump Capacity m. g. d.	Main Supply Metered
IOWA (Cont.)													
Independence M	3,672	U	0.0	.....	.....	.....	10.0	.....	LI	4–12	.....	3.0	...
Kellogg M	603	U	0.1	T	No	No	0.8	I	G	4	2	.....	No
Keota M	1,000	U	0.1	RPp	No	No	7.0	I	GL	4–8	¾	0.05	No
Kingsley M	1,000	U	0.5	T	No	No	4.0	I	GL	4–6	.....	.....	No
Knoxville M	3,523	U	6.5	RPp	O	No	19.0	I	IG	4–10	¾–2	1.1	Yes
Lake City M	2,110	U	0.0	RPpT	No	No	6.7	I	LG	4–10	¾–1	0.1	No
Lake Mills M	1,800	U	0.1	T	O	.....	1.5	I	.....	4–8	.....	0.07	No
La Porte P	1,600	U	0.2	T	No	No	3.5	I	G	4–8	¾	0.5	No
Laurens M	1,000	U	0.0	T	No	No	0.2	I	L	1–4	.....	0.1	No
Lenox M	1,342	S	2.0	RT	F	Ch	8.0	I St	IL	2–6	½–2	0.8	No
Leon M	2,193	U	0.0	RPpT	No	.....	6.0	I	L	4–8	.....	.....	...
Lewis M	650	U	0.0	T	No	No	1.0	GI	G	1½–6	.....	0.2	Yes
McGregor M	1,259	U	0.1	R	.....	.....	2.5	I	.....	4–8	.....	0.8	No
Madrid M	1,191	U	0.3	Pp	.....	.....	1.3	I	G	4–6	.....	0.9	No
Malvern M	1 195	U	....	Pp	.....	.....	....	.....	.....	.....	.....	.....	.....
Manchester M	3,111	U	0.2	RPp	.....	Ch	6.0	.....	G	4–8	.....	2.2	...
Manson M	1,236	U	....	RT	No	.....	7.2	I	L	4–6	½	1.3	Yes
Mapleton M	1,367	U	0.3	T	No	.....	2.0	I	G	4–8	¾–2	0.4	No
Maquoketa M	3,626	SU	0.5	Pp	No	No	13.0	I	LI	4–10	.....	.....	No
Mechanicsville M	817	U	0.0	Pp	.....	.....	1.5	.....	.....	4–6	.....	0.07	...
Mediapolis M	858	U	....	No	No	No	3.0	I	G	6	¾	0.03	...
Minden M	.....	U	....	Pp	No	.....	....	I	G	¾	.....	.....	...
Monona M	1,048	U	1.0	R	No	No	4.5	I	GL	4–8	½–1	0.04	No
Mount Ayr M	1,738	U	1.3	RPpT	No	No	10.0	I	G	4–8	¾	.....	Yes
Mt. Pleasant M	4,500	U	1.0	RPp	No	No	13.0	.....	Wr	2–10	¾–1	2.4	No
Mt. Vernon M	1,532	U	0.2	RT	No	.....	3.0	I	G	4–10	.....	0.4	Yes
Neola M	1,536	U	0.0	T	No	.....	5.0	I	GI	4–6	.....	17.2	Yes
New Hampton M	2,539	U	....	PpT	No	.....	5.5	I	GL	4–8	.....	0.8	No
New London M	1,300	U	0.8	RPp	.....	.....	4.0	I	L	4–8	½–1	0.2	No
Nora Springs M	985	U	0.1	RT	No	No	1.1	I	LG	6	1¼	.....	No
Northwood M	1,500	U	....	Pp	.....	.....	1.8	I	G	4–8	.....	.....	...
Orange City M	1,694	U	0.1	T	No	.....	2.0	I St	G	8	¾	0.09	No
Osceola M	2,750	SU	1.1	RT	No	.....	3.0	I	G	6–8	.....	.....	No
Oxford Junction M	822	U	....	T	.....	.....	1.3	I	.....	4–6	.....	0.2	No
Parkersburg M	1,027	U	0.0	PpT	No	No	2.0	I	.....	6–8	.....	0.08	No
Paullina M	796	U	0.8	RT	No	.....	4.0	I	GL	4–6	.....	0.5	No
Pella M	3,338	U	4.0	T	.....	.....	16.5	I	LI	4–12	.....	2.9	No
Pomeroy M	815	U	0.0	R	No	No	2.0	I	G	4–6	.....	0.1	No
Primghar M	920	U	1.0	R	No	No	2.5	I	G	4–6	.....	0.04	No
Redfield M	1,000	U	0.3	T	.....	.....	2.0	I	G	4–6	¾–2	0.09	No
Rockford M	1,000	U	0.3	Pp	.....	.....	1.5	.....	.....	4–8	.....	0.8	...
Rock Rapids M	2,250	U	0.5	PpT	No	No	8.5	I	GL	4–8	¾–4	0.9	No
Rockwell City M	2,039	U	....	Pp	No	No	2.0	I	LG	4–8	.....	0.3	No
Rolfe M	1,200	U	0.0	RT	No	No	....	I	G	4–6	¾–1	0.2	No
Sabula M	1,000	U	0.3	Pp	No	No	4.0	I	G	4–8	.....	0.06	No
Sac City M	2,630	U	1.0	R	.....	.....	3.0	.....	... . .	2–6	.....	0.04	Yes
Sanborn M	1,474	U	0.3	Pp	No	Ch	4.5	I	.....	4–8	.....	0.06	No
Seymour M	1,800	S	1.0	R	.....	.....	4.5	I	L	2–8	½–¾	.....	...
Sheffield M	1,100	U	0.5	PpT	.....	.....	....	I	G	.....	¾	.....	No
Sibley M	1,802	U	0.5	RPp	No	Ch	5.0	I	G	8	¾–2	0.2	No
Sigourney M	2,210	U	0.0	RPp	.....	.....	6.5	I	GL	4–8	.....	0.6	...
Sloan M	1,125	U	0.0	T	No	No	1.5	I	G	2–6	.....	0.05	No
Spencer M	4,599	U	0.0	Pp	.....	.....	16.0	I	G	4–8	¾	2.6	No
Spirit Lake M	1,800	U	1.5	RT	.....	Ch	4.0	I	GL	4–8	¾–1¼	0.6	Yes
Storm Lake M	3,568	S	1.0	Pp	A	Ch	2.8	.....	G	4–8	.....	21.6	No
Stuart M	2,000	U	0.0	RPp	No	No	7.5	I	.....	4–6	¾	1.0	No
Sumner M	1,511	U	0.2	RT	No	No	4.6	IG	GL	1¼–8	¾–1¼	0.3	No
Tipton M	2,145	U	0.0	RPpT	No	No	5.0	I	G	4–8	¾	0.4	Yes
Toledo M	1,626	U	0.5	RPpT	.....	No	7.5	I	GL	4–8	.....	0.8	Yes
Traer M	1,320	U	0.3	RT	No	.....	4.0	I	GL	4–8	¾	0.4	No
Tripoli M	1,000	U	0.2	R	No	No	2.0	I	I	4–8	.....	0.2	No
Valley Junction M	3,631	U	1.0	Pp	.....	.....	8.0	I	.....	4–6	.....	0.4	...
Villisca M	2,111	U	0.5	PpT	No	No	5.5	I St	I St	2½–8	.....	0.7	No
Vinton M	3,381	SU	....	RPp	.....	.....	9.5	I	.....	4–8	.....	2.5	...
Walnut M	1,072	U	0.5	RPp	No	.....	4.5	I	G	2–8	.....	0.5	No
Wapello M	1,326	U	0.0	No	No	.....	3.0	I	.....	4–6	.....	.....	No
Washington M	4,697	U	....	RT	No	.....	14.0	I	L	.....	.....	2.2	No
Waukon M	2,359	U	0.5	RPp	.....	.....	8.0	I	G	4–10	¾–2	0.5	Yes
West Union M	1,777	U	0.5	Pp	No	No	6.5	I	G	4–8	.....	4.0	No
What Cheer M	1,720	U	0.5	RT	A	Ch	8.0	I	L	4	.....	0.4	No
Williams M	500	U	0.3	T	No	.....	2.0	I	G	4–8	1–2	.....	No
Wilton M	1,128	U	....	T	.....	.....	2.0	I	L	2–6	¾–1¼	0.3	No
Winterset M	3,000	U	1.5	T	No	No	11.9	I	GL	4–8	¾–2	0.9	No
Woodbine M	1,538	U	0.5	Pp	.....	.....	3.3	I	G	4–6	.....	0.3	No

Consumption		Number of Services		Number of Meters		Per Cent Metered		Meter Rates per 1,000 Gallons		Meters Owned by	Hydrants			Average Pressure lbs. per sq. in.	
Average Daily in 1,000 gals.	Per Capita	Domestic	Industrial	Domestic	Industrial	Domestic	Industrial	Max. Dom.	Min. Ind.		Number	Owned by	Aver. Rental each per year	Domestic	Fire
1,500	410	.....	.....	.....	.....	.....	.....	.....	.....	.....	109	.....	.....	60	150
.....	.....	75	.....	75	.....	100	.....	50¢	40¢	H	12	M	.....	.....	.....
5	5	150	.....	200	.....	100	.....	30¢	30¢	H	65	M	.....	55	55
.....	.....	200	.....	197	.....	99	.....	50¢	.....	M	33	M	.....	65	65
300	85	875	1	875	1	100	100	00¢	20¢	H	66	M	.....	60	70
60	28	343	2	331	2	97	100	$1.20	25¢	H	18	.....	.....	35	.....
30	17	400	2	350	2	88	100	40¢	20¢	M	16	M	.....	40	40
17	11	240	.....	225	.....	94	.....	40¢	20¢	P	32	P	.....	45	80
4	4	50	None	55	.....	100	.....	40¢	30¢	H	20	M	.....	40	40
45	34	190	10	190	10	100	100	00¢	00¢	H	40	M	$30	50	50
55	25	.....	.....	350	.....	.....	.....	00¢	.....	M	95	M	None	80	.....
30	46	210	.....	None	.....	.....	.....	.....	.....	.....	10	M	None	42	42
60	48	127	.....	125	.....	99	.....	40¢	20¢	H	30	M	.....	87	100
4	3	.....	.....	120	.....	.....	.....	35¢	35¢	H	23	M	.....	45	45
9	8	145	35	130	35	90	100	40¢	40¢	H	20	.....	.....	.....	.....
250	80	575	.....	500	.....	87	.....	50¢	20¢	M	65	.....	.....	60	125
60	49	400	30	400	30	100	100	40¢	25¢	H	44	M	.....	50	100
10	7	300	5	5	.....	2	.....	35¢	.....	H	21	M	.....	85	100
250	69	1,200	.....	1,200	.....	100	.....	17¢	10¢	M	112	M	.....	84	125
15	13	150	.....	150	.....	100	.....	.....	.....	.....	27	.....	.....	52	.....
.....	.....	48	.....	67	.....	100	.....	75¢	40¢	M	26	M	.....	50	75
1	.....	.....	.....	70	.....	.....	.....	50¢	.....	M	16	M	.....	75	75
30	29	245	5	245	5	100	100	40¢	35¢	H	28	M	.....	50	54
50	29	110	35	86	35	78	100	50¢	10¢	H	49	M	.....	50	50
125	28	824	.....	824	.....	100	.....	50¢	20¢	M	84	M	None	35	110
100	65	300	75	300	75	100	100	40¢	40¢	H	49	M	.....	77	80
8	5	.....	.....	110	20	.....	.....	50¢	30¢	M	21	M	.....	75	100
110	43	750	.....	750	.....	100	.....	30¢	0¢	M	62	M	.....	45	125
20	15	165	.....	165	.....	100	.....	50¢	.....	H	37	.....	.....	55	55
25	25	185	.....	182	.....	100	.....	42¢	.....	H	27	M	None	60	60
25	17	175	.....	175	.....	100	.....	25¢	25¢	.....	21	M	.....	51	51
15	9	118	42	118	42	100	100	40¢	40¢	M	28	M	None	50	50
60	22	225	.....	225	.....	100	.....	75¢	75¢	M	37	M	.....	43	98
50	61	120	.....	.....	.....	.....	.....	.....	.....	.....	17	M	.....	65	.....
8	8	200	.....	198	.....	99	.....	40¢	.....	H	12	M	.....	110	110
50	63	240	.....	8	.....	33	.....	.....	.....	.....	36	M	None	40	60
800	240	700	6	494	6	71	100	50¢	20¢	.....	100	.....	.....	50	86
8	10	145	5	140	5	97	100	30¢	30¢	H	18	M	.....	125	125
25	27	100	3	100	3	100	100	.....	.....	H	29	M	None	65	65
7	7	156	.....	156	.....	100	.....	50¢	50¢	MH	31	M	None	60	60
80	80	129	.....	1	.....	1	.....	31¢	15¢	M	21	.....	.....	40	135
150	67	610	.....	525	.....	86	.....	25¢	.....	H	48	M	.....	65	75
140	69	425	.....	425	.....	100	.....	50¢	25¢	H	62	M	.....	43	90
20	17	200	4	200	4	100	100	54¢	33¢	H	22	M	None	35	120
50	50	172	.....	None	.....	.....	.....	.....	.....	.....	30	M	.....	12	70
125	49	370	.....	150	.....	41	.....	00¢	20¢	.....	130	M	.....	45	67
88	60	75	.....	65	.....	87	.....	.....	.....	.....	25	.....	.....	45	45
.....	.....	.....	.....	.....	.....	.....	.....	25¢	25¢	M	39	M	.....	50	100
12	11	170	.....	170	.....	100	.....	45¢	15¢	H	25	M	None	150	50
70	39	325	.....	325	.....	100	.....	50¢	40¢	M	55	M	.....	45	90
200	90	450	30	425	30	95	100	.....	.....	H	30	M	.....	40	140
300	266	.....	.....	65	.....	.....	.....	30¢	.....	H	24	M	.....	50	50
300	66	806	.....	787	.....	98	.....	35¢	15¢	M	83	M	None	60	100
152	85	473	7	473	7	100	100	40¢	10¢	H	59	M	None	60	150
270	76	200	.....	50	.....	25	.....	35¢	11¢	H	94	M	.....	50	120
40	20	200	.....	40	.....	20	.....	60¢	60¢	M	40	M	.....	54	54
50	33	400	.....	400	.....	100	.....	40¢	15¢	H	33	M	.....	55	.....
130	61	652	.....	652	.....	100	.....	50¢	50¢	M	58	.....	.....	40	150
100	62	400	.....	360	.....	90	.....	40¢	20¢	.....	58	M	None	80	90
.....	.....	285	50	200	50	70	100	48¢	18¢	H	36	M	.....	75	75
.....	.....	130	.....	125	.....	95	.....	40¢	10¢	H	35	M	.....	50	50
400	113	775	.....	725	.....	94	.....	35¢	25¢	.....	64	M	.....	83	83
100	47	350	1	350	1	100	100	50¢	10¢	H	42	M	No	53	75
190	56	720	180	700	180	97	100	40¢	20¢	H	60	M	.....	67	110
4	4	70	21	70	21	100	100	$1.20	80¢	H	41	M	.....	50	100
55	41	.....	.....	.....	.....	.....	.....	40¢	.....	M	125	.....	.....	.....	.....
300	64	1,200	.....	1,200	.....	100	.....	40¢	15¢	H	149	.....	.....	53	90
140	60	620	.....	620	.....	100	.....	50¢	35¢	H	70	M	.. ..	65	100
.....	.....	400	.....	.....	.....	.....	.....	.....	.....	H	30	M	.....	60	100
30	17	220	None	220	None	100	.....	50¢	.....	H	22	M	None	15	15
1	2	120	.....	120	.....	100	.....	45¢	.....	H	17	M	.....	46	46
40	36	269	2	269	2	100	100	60¢	30¢	H	20	M	.....	40	120
75	25	490	.....	490	.....	100	.....	40¢	15¢	H	49	M	None	50	50
60	39	340	.....	325	.....	96	.....	35¢	.....	H	33	M	.....	50	50

Municipality Ownership of Water works	Population	Source		Storage	Filters	Sterilized	Distribution System			Pipe Sizes Inches		Pump Capacity m. g. d.	Main Supply Metered
		Type	Aver. Miles from City				Total Miles of Main	Kind of Pipe		Mains	Services		
								Mains	Services				
KANSAS													
Alma.....M	1,258	U	....	RT	No	.....	5.0	I	G	2–6	¾–1	0.2	No
Arcadia.....M	.....	U	1.0	R	.....	.....	7.5	I	G	2–6	¾	0.4	No
Arma.....M	2,560	U	0.0	RT	No	No	11.4	I	GL	2–6	1–1	0.4	No
Attica.....M	800	U	1.0	Pp	No	No	2.8	I	G	2–8	.....	0.6	No
Augusta.....M	4,219	S	1.0	Pp	.....	.....	9.0	.....	.....	2–8	.....	1.4	...
Baxter Springs.....M	3,608	U	0.5	RT	No	No	....	.....	G	6–12	¾	.....	No
Belleville.....M	2,254	U	0.5	RPp	.....	.....	6.0	I	I	4–8	.....	0.2	Yes
Beloit.....M	2,900	S	0.0	RPpT	.....	.....	8.0	I	I	4–10	¾	.....	Yes
Blue Rapids.....M	1,977	U	0.3	R	.....	No	4.0	I	.....	¾–2	.....	0.6	Yes
Bonner Springs.....M	2,000	U	0.5	PpT	.....	No	6.0	I	GI	1½–6	¾–1	0.4	No
Bucklin.....M	1,034	U	0.0	Pp	.....	.....	3.5	.....	.....	2–8	.....	0.3	Yes
Burlingame.....M	1,330	S	3.0	Pp	A	Hy	6.4	I	GWrL	4–8	¾	0.4	No
Burrton.....M	1,125	U	....	Pp	....	No	7.0	I	I	4–8	2–4	0.4	No
Caldwell.....M	2,191	U	7.3	RPp	No	.....	8.8	I	GL	4–10	.....	3.4	Yes
Caney.....M	3,427	S	1.0	Pp	.....	.....	10.0	I	.....	4–12	.....	4.7	...
Cawker City.....M	1,233	U	1.5	Pp	.....	.....	4.5	I	G	4–6	¾–1	.....	No
Cedar Vale.....M	1,000	S	0.3	Pp	.....	.....	1.5	I	G	2–6	¾–1	0.7	Yes
Cherokee.....M	1,452	U	0.0	RT	.....	.....	6.0	I	G	4–8	.....	0.5	...
Cherryvale.....M	4,698	S	6.0	RPp	A	Ch	28.0	I	GL	2–12	1–¾	4.5	...
Clyde.....M	1,063	U	0.1	Pp	No	No	4.5	I	G	4–12	.....	0.5	No
Columbus.....M	3,155	U	0.3	RPp	.....	.....	6.0	.....	G	4–8	.....	1.4	...
Conway Springs.....P	1,200	U	0.5	T	.....	.....	2.0	I	G	2–6	¾	.....	No
Cottonwood Falls.....M	1,100	U	1.0	RPp	No	No	5.0	I	G	4–8	¾–1	0.6	No
Council Grove.....M	2,857	S	0.5	RPp	A	Ch	6.1	I	G	4–12	1–1	1.5	Yes
Douglass.....M	1,533	S	1.0	Pp	.....	.....	5.5	I	GL	4–6	.....	0.4	No
Downs.....M	1,427	U	0.1	Pp	.....	.....	8.0	I	.....	2–6	.....	0.2	Yes
Elkhart.....M	1,600	U	0.0	RPp	No	No	5.0	I	GL	4–8	¾	.....	No
Ellinwood.....M	1,103	U	....	Pp	No	.....	4.0	I	L	4–8	.....	1.2	No
Ellsworth.....M	2,065	U	1.0	T	No	Ch	8.0	I	GL	4–8	¾–1	0.5	Yes
Erie.....M	1,200	SU	1.0	Pp	A	Ch	3.5	I St	G	1–8	¾	1.0	No
Florence.....M	2,300	U	1.3	Pp	.....	.....	5.5	I St	GL	4–10	¾	1.0	No
Fort Riley.....M	2,700	U	1.3	R	No	No	8.7	I	G	4–14	¾–2	7.0	Yes
Fowler.....M	600	U	0.0	Pp	No	No	2.3	.....	G	4–8	¾	0.2	No
Frankfort.....M	1,426	U	0.1	RT	No	No	2.5	IG	L	1½–8	1	0.9	No
Fredonia.....M	3,954	S	1.5	R	A	Hy	10.0	IG	WrG	4–12	¾	5.0	No
Garden City.....M	3,848	U	0.5	Pp	No	No	14.5	I	GL	3–10	¾–¾	4.0	No
Girard.....M	3,161	U	0.3	RPp	No	No	12.0	I	LG	4–8	¾	1.9	No
Glen Elder.....M	1,096	U	0.4	Pp	.....	.....	2.4	I	I	4–6	.....	0.5	Yes
Goodland.....M	2,664	U	....	Pp	No	No	11.0	.....	.....	2–10	.....	0.6	...
Great Bend.....P	4,500	U	1.0	None	No	.....	11.0	I	GL	4–12	¾–4	2.2	Yes
Halstead.....M	1,163	U	0.5	T	No	No	7.0	I	G	4–8	.....	2.2	...
Haven.....M	650	U	0.3	T	No	No	4.0	I St	G	2–4	1	0.3	No
Hays.....M	4,400	U	0.5	T	No	.....	10.8	I St	GWr	2–8	¾–2	1.7	Yes
Herington.....M	4,065	SU	3.0	RPp	A	Ch	20.0	I	L	4–10	¾	2.1	Yes
Hiawatha.....M	3,222	U	3.5	RPp	.....	.....	12.0	I	L	4–10	.....	1.0	Yes
Hill City.....M	1,100	U	1.0	T	No	No	8.0	I	G	4–8	¾	0.5	No
Hoisington.....M	3,200	U	0.8	Pp	No	.....	9.5	I	GL	4–10	¾	0.5	Yes
Holton.....M	4,009	U	3.5	RPp	.....	.....	5.5	I	G	4–10	¾–1	0.6	Yes
Humboldt.....M	3,500	S	0.8	T	A	Ch	25.0	I St	GWr	2–10	¾–1¼	2.2	No
Jewell City.....M	1,000	SU	1.0	RT	A	Hy	7.0	I	G	4–8	¾	0.3	No
Kingman.....M	2,407	U	3.5	RPp	No	.....	5.0	I	G	2–8	.....	0.9	...
Lansing.....M	1,300	U	1.5	R	No	Hy	4.0	I	G	4–10	2–6	1.6	No
Liberal.....M	3,613	U	1.0	RPp	No	No	14.0	I	L	4–8	.....	0.7	...
Lincoln.....M	1,508	U	0.5	Pp	.....	.....	4.5	I	L	4–8	.....	0.2	...
Lindsborg.....M	2,000	U	0.2	R	.....	.....	7.0	I	.....	4–8	.....	2.4	No
Luray.....M	540	U	0.3	T	.....	.....	3.4	I St	GL	4–6	1–¾	0.5	No
Lyndon.....M	1,000	S	0.5	T	O	Hy	3.6	I	G	4–6	¾–2	0.3	No
Lyons.....M	2,516	U	2.0	R	.....	.....	9.0	I	G	4–8	.....	0.9	No
Mankato.....M	1,300	U	1.0	Pp	.....	.....	....	.....	.....	4–8	.....	1.9	No
McPherson.....M	4,595	U	....	Pp	.....	.....	12.0	I	L	4–12	¾–3	2.9	Yes
Marion.....M	1,975	S	0.5	Pp	A	Ch	9.5	IWrLl	G	4–10	¾	0.9	Yes
Meade.....M	1,312	U	0.5	RT	No	No	11.8	I	G	4–8	¾–1	0.5	No
Medicine Lodge.....M	1,400	S	4.5	R	.....	.....	4.5	I St	.....	1¼–8	¾–2	3.2	No
Miltonvale.....M	1,200	U	0.1	Pp	A	No	5.0	I	L	2–6	⅝	0.9	No
Minneapolis.....M	1,842	U	0.1	Pp	.....	.....	8.0	I	I	4–10	.....	2.0	Yes
Moline.....M	1,000	U	0.0	Pp	.....	.....	1.6	I	G	4–8	.....	0.2	No
Mound City.....M	1,435	S	0.5	R	O	.....	5.5	I	G	4–6	¾	1.0	No
Mulberry.....M	2,697	U	0.0	RPp	No	No	5.5	I	G	2–8	.....	0.4	...
Mulvane.....M	1,400	U	0.3	T	No	No	4.0	I	G	4–8	1	0.8	No
Neodesha.....M	3,943	S	0.3	RPp	A	Ch	116.0	Wr	L	4–8	¾	6.6	Yes
Nickerson.....M	1,049	U	0.0	T	No	No	4.0	I	G	4–8	¾–2	0.9	No
Norton.....M	2,186	U	0.3	RPp	No	.....	6.0	I	G	3–12	¾	2.5	No
Oakley.....M	1,000	U	0.5	T	.....	.....	4.0	I	G	4–8	¾–2	0.2	No

Consumption		Number of Services		Number of Meters		Per Cent Metered		Meter Rates per 1,000 Gallons		Meters Owned by	Hydrants			Average Pressure lbs. per sq. in.	
Average Daily in 1,000 gals.	Per Capita	Domestic	Industrial	Domestic	Industrial	Domestic	Industrial	Max. Dom.	Min. Ind.		Number	Owned by	Aver. Rental each per year	Domestic	Fire
15	120	107	3	107	3	100	100	50¢	25¢	.....	30	M	.....	45	300
30	.....	275	4	275	4	100	100	38¢	15¢	M	35	M	.....	135	135
42	164	400	50	400	50	100	100	38¢	20¢	M	30	M	.....	50	80
75	94	200	2	200	2	100	100	75¢	10¢	M	18	M	None	65	65
360	85	400	.....	400	.....	100	.....	25¢	15¢	M	50	M	.....	60	225
280	78	1,203	.....	1,135	.....	95	.....	60¢	15¢	M	20	M	.....	50	.....
150	67	600	.....	600	.....	100	100	75¢	15¢	.....	68	M	.....	48	130
450	155	.....	.....	.....	.....	.....	.....	33¢	25¢	H	88	.....	.....	78	185
100	51	400	4	380	4	95	100	30¢	10¢	M	27	.....	.....	80	120
50	25	350	.....	350	.....	100	.....	.....	.....	H	38	M	.....	68	98
39	38	240	.....	240	.....	100	.....	25¢	20¢	H	23	M	.....	52	52
65	49	260	None	260	.....	100	.....	30¢	.....	H	35	M	.....	65	65
68	60	93	3	160	3	100	100	13¢	15¢	M	39	M	None	56	120
350	160	610	7	610	7	100	100	35¢	7¢	H	75	M	$20	40	65
600	175	1,000	10	975	0	98	0	66¢	8¢	M	53	.....	.....	70	.....
100	81	161	23	161	10	100	43	36¢	15¢	M	26	M	.....	58	100
60	60	260	.....	3	.....	1	.....	30¢	20¢	M	20	M	.....	60	100
130	90	412	4	402	4	98	100	50¢	12¢	M	45	.....	.....	40	75
350	75	1,250	6	1,250	6	100	100	60¢	12¢	M	93	M	.....	80	120
180	170	100	.....	90	.....	90	100	15¢	8¢	MH	40	.....	.....	65	100
90	29	475	.....	240	.....	51	.....	50¢	20¢	.....	85	.....	.....	60	125
100	83	200	5	170	5	85	100	24¢	8¢	PH	25	M	.....	40	60
50	45	275	3	275	3	100	100	30¢	20¢	H	36	M	.....	54	54
300	105	560	8	401	8	72	100	30¢	8¢	H	62	M	None	55	90
50	33	150	.....	125	.....	83	.....	.....	.....	M	30	M	.....	53	53
100	71	325	.....	325	.....	100	.....	20¢	20¢	H	40	M	.....	60	75
75	47	350	10	350	10	100	100	$1	25¢	M	30	M	$30	35	100
50	45	110	.....	110	.....	100	.....	15¢	10¢	H	25	M	$75	55	125
175	85	400	35	400	35	100	100	30¢	15¢	M	78	M	.....	75	75
250	208	450	2	450	2	100	100	50¢	10¢	H	35	M	None	53	80
125	54	350	4	350	4	100	100	30¢	30¢	H	46	M	.....	65	100
800	30	220	1	None	None	.....	.....	.....	.....	.....	74	M	.....	75	130
10	17	120	25	120	25	100	100	20¢	15¢	M	22	M	.....	32	70
.....	.....	367	6	367	6	100	100	50¢	15¢	.....	33	M	None	60	75
400	101	1,050	.....	850	.....	85	100	25¢	10¢	M	76	M	None	65	85
180	47	800	.....	685	.....	86	.....	10¢	.....	M	107	M	.....	40	115
120	38	434	.....	300	.....	69	.....	38¢	38¢	M	75	M	.....	43	80
500	456	225	None	225	None	100	.....	25¢	.....	M	23	.....	.....	30	56
100	38	2,300	.....	550	.....	42	.....	.....	.....	H	550	.....	.....	40	100
350	78	850	.....	848	.....	99	.....	30¢	13¢	P	89	P	$45	60	120
80	69	.....	.....	.....	.....	.....	.....	$1.00	10¢	.....	46	M	.....	43	70
25	38	55	20	55	20	100	100	33¢	30¢	M	25	M	.....	45	45
400	91	780	60	780	60	100	100	27¢	14¢	M	88	M	.....	55	75
350	86	900	15	900	15	100	100	40¢	10¢	M	60	M	.....	70	100
225	70	875	20	875	20	100	100	40¢	15¢	M	64	M	.....	60	100
60	55	315	3	300	3	95	100	63¢	25¢	H	54	M	.....	20	80
125	39	875	3	875	3	100	100	53¢	20¢	H	53	M	$36	40	45
75	19	669	.....	668	.....	100	.....	$1	20¢	M	55	M	.....	80	80
250	71	900	12	888	12	99	100	35¢	13¢	M	52	M	.....	45	45
40	40	200	.....	195	.....	98	.....	38¢	25¢	M	41	M	None	60	77
24	10	950	.....	950	.....	100	100	50¢	7¢	M	53	M	.....	60	75
150	115	.....	.....	.....	.....	.....	.....	.....	.....	.....	16	M	.....	40	100
250	69	730	.....	730	.....	100	.....	50¢	20¢	H	62	M	.....	50	85
115	77	400	.....	400	..	100	.....	15¢	15¢	H	30	M	.....	50	65
720	360	500	.....	475	.....	95	.....	75¢	8¢	.....	53	.....	.....	50	110
45	83	150	.....	138	.....	92	.....	40¢	20¢	M	25	M	.....	63	78
35	35	175	21	175	21	100	100	50¢	15¢	H	29	M	None	50	68
300	120	770	.....	610	.....	79	.....	25¢	8¢	M	66	M	.....	50	120
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	H	35	.....	.....	43	43
350	76	1,236	.....	1,236	.....	100	100	25¢	8¢	M	82	.....	.....	45	80
200	100	280	10	276	10	98	100	25¢	12¢	M	79	M	.....	70	70
100	76	273	2	265	3	97	100	30¢	13¢	M	18	M	None	45	75
.....	.....	380	3	.....	2	.....	67	.....	.....	M	32	M	None	30	90
75	63	165	37	165	37	100	100	50¢	10¢	M	22	M	.....	60	110
200	109	600	.....	600	.....	100	.....	25¢	5¢	M	82	M	None	45	125
.....	.....	.....	.....	.....	.....	.....	.....	50¢	25¢	M	22	M	.....	49	49
20	14	140	18	140	18	100	100	$1	25¢	M	22	M	$35	63	63
175	65	667	5	473	5	71	100	25¢	.....	M	29	M	None	65	85
200	143	300	30	300	30	100	100	25¢	10¢	M	35	M	.....	50	150
820	208	1,025	25	1,025	25	100	100	25¢	6¢	M	50	M	.....	50	.....
100	96	150	1	150	1	100	100	20¢	5¢	M	31	M	None	55	125
300	144	400	.....	400	.....	100	.....	18¢	15¢	H	40	M	None	70	110
140	140	250	.....	250	.....	100	.....	13¢	10¢	M	42	M	.....	45	75

Municipality Ownership of Water works	Population	Source Type	Source Aver. Miles from City	Storage	Filters	Sterilised	Distribution System Total Miles of Main	Distribution System Kind of Pipe Mains	Distribution System Kind of Pipe Services	Pipe Sizes Inches Mains	Pipe Sizes Inches Services	Pump Capacity m. g. d.	Main Supply Metered
KANSAS (Cont													
Oberlin.....M	1,247	U	0.1	Pp	.....	.....	3.0	I	G	4-12	¾	2.5	No
Olathe.....M	3,268	S	1.0	RPpT	A	Cb	12.0	I	I	4-8	½-¾-1	2.5	No
Osage City.....M	2,376	S	1.5	Pp	.....	.....	13.0	.....	G	2-10	.....	4.8	No
Osawatomie.....M	4,772	S	0.8	RPp	A	Ch	8.0	I	GL	4-10	.....	1.5	No
Osborne.....M	2,000	S	1.3	PpT	A	Ch	5.0	.....	G	4-6	¾	1.1	Yes
Paola.....M	3,238	S	1.5	RPp	A	Ch	7.5	I St	G	4-10	¾	2.0	No
Peabody.....M	2,455	U	0.5	T	.....	.....	7.0	I	G	2-8	¾	0.7	...
Phillipsburg.....M	1,310	S	7.0	RPp	A	Ch	9.0	I St	.....	2-8	½-1½	1.1	No
Plainville.....M	1,230	U	1.0	PpT	No	No	5.5	I	G	2-6	¾	3.2	Yes
Pleasanton.....M	1,653	S	1.5	R	A	.....	4.0	I	.....	4-8	.....	0.2	No
Protection.....M	1,534	SU	0.1	Pp	No	No	3.0	I	GL	4-8	¾-2	0.6	No
Russell.....M	2,600	U	5.5	RT	.....	Ch	7.0	I	GL	4-8	¾-¾	0.9	No
Sabetha.....M	2,003	U	0.3	RPp	.....	Ch	12.0	I	Wr L	4-10	.....	0.4	...
St. Marys.....M	1,321	U	0.3	Pp	.....	.....	3.0	I	.....	4-8	.....	0.4	No
Scandia.....M	1,089	U	0.1	Pp	No	No	3.0	I	Wr G	4-8	¾	0.5	...
Scott City.....M	1,379	U	....	T	.....	.....	4.0	I	G	4-8	¾	0.9	No
Sedan.....M	1,885	S	1.0	Pp	No	.....	5.9	I	GL	4-8	¾	2.2	No
Sedgwick.....M	731	U	0.0	Pp	No	No	4.0	I	G	2-8	¾-1	0.4	No
Seneca.....M	1,885	U	0.8	Pp	.....	.....	4.0	I	.....	4-10	.....	1.2	...
Smith Center.....M	1,700	S	10.5	RPp	A	Ch	16.0	I	G	4-8	¾	0.5	Yes
Solomon.....M	1,190	U	1.5	T	.....	..	6.5	I	GL	2-6	.....	0.4	No
Spearville.....M	1,720	U	.....	Pp	.....	.....	4.0	.....	.....	4-8	.....	0.3	...
Stafford.....M	1,796	U	0.0	PpT	No	No	7.0	I	L	4-8	¾-2	0.6	No
Stockton.....M	1,324	U	0.5	Pp	No	.....	6.0	I Wr	Wr L	2-8	¾	0.7	No
Syracuse.....M	1,267	U	0.3	RPp	No	No	3.8	.....	G	4-8	.....	0.4	No
Tonganoxie.....M	971	U	1.5	Pp	.....	.....	2.8	.....	G	4-6	.....	.....	No
Wakeeney.....M	2,073	U	3.0	Pp	.....	.....	4.0	I	G	4-6	.....	0.5	No
Wamego.....M	1,585	U	0.6	Pp	No	No	7.1	IG	G	4-8	½-2	0.9	No
Washington.....M	1,500	S	1.0	Pp	A	Hy	9.0	I	I/G	4-8	½-2	1.4	No
Waterville.....M	1,140	U	0.3	RPpT	No	No	2.8	I	G	4-8	¾	0.4	No
Waverly.....M	1,000	U	1.0	RT	No	No	2.0	I	G	2-6	¾	0.7	No
Wilson.....M	1,445	U	1.5	T	No	No	4.8	I	G Wr	4-8	¾-2	0.6	No
KENTUCKY													
Adairville.....M	2,336	U	0.5	RPp	.....	.....	3.0	.....	.....	1½-3	.....	0.07	...
Berea.....P	1,510	U	6.0	R	.....	Ch	8.0	I	.....	.....	.....	0.1	...
Carlisle.....M	1,293	S	0.8	RPp	.....	.....	....	I	Wr	4-10	¾	.....	No
Carrollton.....M	2,281	U	0.0	....	.....	.....	6.0	I	G	4-12	.....	2.1	...
Clifton.....M	3,450	S	5.0	R	.....	.....	....	.....	.....	4-6	½-1	.....	Yes
Cynthiana.....M	3,857	S	0.3	Pp	.....	.....	8.0	I	L	4-10	¾-1	1.0	No
Dawson Springs.....P	1,500	U	1.0	RT	No	No	3.0	I	GI	6-8	.....	0.2	No
Elizabethtown.....M	2,530	U	1.5	Pp	.....	.....	6.0	.....	.....	4-8	.....	0.5	Yes
Glasgow.....P	2,559	S	0.8	RT	No	Ch	6.0	I	I	4-8	.....	1.3	No
Hawesville.....P	1,000	S	0.1	R	No	.....	2.0	I	G	4-6	½-1	2.9	No
Hickman.....P	4,600	U	0.0	Pp	No	No	4.8	I	L	3-8	.....	0.8	No
Kuttawa.....P	3,411	S	0.5	RT	.....	.....	2.5	I St	I St	4-6	½-1¼	0.5	No
Lancaster.....M	2,166	S	1.3	RT	O	.....	4.3	I	G	4-8	.....	1.0	No
Lawrenceburg.....M	1,723	S	3.0	Pp	F	Ch	7.0	I	I	4-6	.....	0.3	No
Livermore.....P	2,000	S	200	No	No	No	2.0	.....	G	4	¾	0.2	No
Morganfield.....M	2,651	S	0.3	RPp	A	.....	10.0	I	G	4-12	.....	1.4	...
Mt. Sterling.....P	3,995	S	6.0	Pp	O	Hy	12.0	.....	I	4-12	.....	0.6	No
Nicholasville.....M	2,786	SU	2.5	RPp	.....	.....	4.5	I	GL	4-10	½-2	1.5	No
Princeton.....M	3,689	U	0.8	R	No	Ch	9.8	I St	L St	4-8	1-8	0.1	No
Scottsville.....M	2,500	U	1.0	RPp	No	No	3.5	IG	G	1-8	.....	0.4	No
Shelbyville.....P	3,760	S	1.0	RPp	O	.....	6.8	I	G	4-8	.....	1.0	No
Somerset.....P	4,672	S	2.0	R	.....	.....	7.5	I	G	1½	½-¾	1.8	No
LOUISIANA													
Amite.....M	1,677	U	....	RT	.....	.....	8.0	I	G	2-8	¾	2.1	No
Bastrop.....M	2,500	U	....	T	.....	.....	5.0	I	.....	2-8	.....	0.9	No
Covington.....M	2,942	U	0.2	RT	A	No	10.0	I	G	3-8	¾-3	0.3	No
Donaldsonville.....M	3,745	S	....	.....	.....	.....	8.0	I	G	4-12	.....	3.0	...
Gueydan.....M	1,400	U	0.0	RT	No	No	1.3	I	G	6-8	½-¾	0.9	No
Lake Arthur.....M	1,880	U	0.3	T	No	.....	2.5	I	G	4-8	¾-2	0.4	No
Lecompte.....M	1,200	U	0.1	RT	No	No	5.0	I	G	8	2	1.1	No
Leesville.....P	2,518	U	5.0	RPpT	No	No	4.0	I St	G	2-8	½	0.5	No
New Roads.....M	1,500	U	0.5	RPpT	A	....	3.0	.. ..	I	2-8	¾-1	0.2	No
Patterson.....M	3,700	S	0.2	.....	.....	.....	3.0	.....	G	6-8	.....	.....	No
Rayne.....M	2,720	U	0.0	RPp	.....	No	6.2	I St	G	6 8	¾-2	2.2	No
Rayville.....M	2,500	U	0.1	RT	No	No	3.0	I St	G	4-8	¾-2	1.9	No
St. Francisville.....M	1,000	U	0.0	RT	No	No	2.5	I	G	4-8	.....	0.4	No
Tallulah.....M	2,000	U	0.0	RT	No	No	2.0	I	G	4-8	¾-2	1.4	No
Thibodaux.....M	3'526	SU	....	Pp	.....	.....	6.8	I	G	4-8	¾-2	1.5	...
Vidalia.....M	1,345	U	0.5	RT	A	.....	6.0	I	G	4-8	½-2	2.9	No
West Monroe.....M	4,100	U	....	RT	No	No	10.0	I	G	10	¾	1.4	No

Consumption		Number of Services		Number of Meters		Per Cent Metered		Meter Rates per 1,000 Gallons		Meters Owned by	Hydrants			Average Pressure lbs. per sq. in.	
Average Daily in 1,000 gals.	Per Capita	Domestic	Industrial	Domestic	Industrial	Domestic	Industrial	Max. Dom.	Min. Ind.		Number	Owned by	Aver. Rental each per year	Domestic	Fire
120	96	350	.....	350	.....	100	.....	18¢	....	H	32	M	.....	60	100
175	54	960	10	960	10	100	100	54¢	24¢	H	90	M	None	70	70
60	25	550	.....	550	.....	100	.....	40¢	15¢	H	78	M	None	43	150
800	168	680	5	680	5	100	100	35¢	12¢	H	70	M	.....	70	98
120	60	500	50	500	40	100	80	20¢	20¢	M	60	M	.....	40	45
350	108	1,000	50	1,000	50	100	100	45¢	15¢	M	73	M	$29	55	120
100	41	400	.....	400	.....	100	.....	40¢	20¢	M	69	M	.....	70	70
75	57	370	5	360	5	97	100	60¢	20¢	H	65	M	None	35	67
110	90	290	2	275	2	95	100	20¢	....	M	28	M	.....	55	55
60	36	290	10	200	10	69	100	50¢	20¢	M	54	M	None	50	60
100	65	190	2	190	2	100	100	20¢	10¢	M	28	M	$35	55	55
150	58	300	100	300	100	100	100	25¢	15¢	H	51	M	.....	50	125
95	47	350	.....	175	.....	50	.....	40¢	20¢	M	74	M	$17	58	120
15	11	178	.....	170	.....	95	.....	50¢	17¢	M	55	M	.....	83	83
100	91	160	.....	25	.....	16	.....	20¢	....	M	23	.....	.....	45	110
100	73	250	.....	250	.....	100	.....	10¢	....	M	32	M	None	49	49
150	80	300	30	300	29	100	97	30¢	20¢	M	43	M	.....	61	61
45	62	267	2	267	2	100	100	25¢	20¢	.....	41	M	None	56	56
125	66	600	.....	250	.....	42	.....	.....	.....	.....	36	.....	.....	45	250
95	56	280	100	280	100	100	100	28¢	28¢	H	40	M	.....	60	130
25	21	180	.....	180	.....	100	.....	50¢	20¢	M	180	M	None	65	65
50	29	125	.....	.....	.....	.....	.....	..	25¢	M	30	....	.....	100	225
50	28	325	2	325	2	100	100	25¢	.....	M	50	M	.....	45	45
.....	.....	270	.....	250	.....	93	.....	15¢	15¢	M	27	M	.....	85	85
50	40	150	.....	150	.....	100	.....	15¢	15¢	M	31	M	..	58	125
113	117	136	4	136	4	100	100	45¢	20¢	H	30	M	.....	61	.....
350	169	300	.....	300	.....	100	.....	25¢	15¢	M	34	M	.....	60	125
150	95	475	25	475	25	100	100	30¢	8¢	H	45	M	.....	60	100
100	68	400	4	400	4	100	100	33¢	10¢	M	55	M	.....	45	.....
18	16	150	.....	150	.....	100	.....	45¢	.....	M	20	M	.....	64	64
10	10	100	.....	20	.....	5	.....	50¢	.....	M	13	M	.....	45	112
75	52	350	.....	300	.....	86	.....	25¢	25¢	M	40	M	.....	65	65
30	13	.....	.....	.....	.....	.....	.....	....	....	.....	24	M	.....	30	90
150	99	200	.....	160	.....	80	.....	20¢	....	P	30	P	.....	90	90
35	27	300	.....	225	.....	75	.....	40¢	22¢	M	36	M	.....	45	45
600	263	600	.....	600	.....	100	.....	40¢	15¢	M	40	....	.....	105	140
.....	.....	.....	.....	.....	.....	.....	.....	30¢	30¢	H	87	M	.....	90	90
640	166	750	.....	30	.....	4	.....	20¢	8¢	M	83	M	$5	100	100
100	67	200	10	None	.....	.....	.....	50¢	30¢	H	14	P	$75	53	.....
350	138	500	50	.....	50	.....	100	.....	.....	.....	50	M	.....	45	80
350	137	375	25	135	15	36	60	48¢	30¢	P	30	P	$50	40	60
40	40	145	.....	None	.....	.. ..	.....	.....	.....	.....	11	P	$42	80	90
221	48	552	.....	372	.....	68	.....	70¢	33¢	P	38	P	$40	90	90
60	18	164	3	10	3	6	100	50¢	....	P	11	M	.....	80	80
50	23	181	2	181	.....	100	.....	60¢	15¢	H	40	M	.....	40	150
125	73	370	5	200	5	54	100	30¢	15¢	M	49	M	.....	56	75
30	15	50	2	None	None	.....	.....	.....	.....	.....	.....	.....	.....	40	100
175	66	300	.....	130	.....	43	.....	.....	....	H	60	M	.....	60	120
170	43	875	.....	875	.....	100	.....	40¢	20¢	P	112	P	$40	75	75
100	36	375	.....	350	.....	93	.....	35¢	....	M	75	M	.....	60	70
150	41	640	10	650	10	100	100	70¢	30¢	H	90	M	.....	50	100
30	12	140	10	52	10	37	100	75¢	50¢	M	21	M	None	70	70
100	27	600	.....	250	.....	42	.....	30¢	30¢	P	60	P	$41	80	120
500	107	1,026	.....	1,577	.....	97	.....	50¢	50¢	P	63	P	$50	135	135
37	21	190	2	190	None	100	.....	30¢	.....	M	44	M	None	65	125
220	88	.....	.....	.....	.....	.....	.....	15¢	8¢	M	50	....	.....	55	120
83	28	400	.....	400	.....	100	.....	30¢	....	M	71	M	.....	60	125
200	54	278	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45	100
85	61	90	10	.....	.....	.....	.....	.....	.....	.....	15	M	.....	50	45
30	16	70	1	None	None	.....	.....	.....	.....	.....	19	M	None	74	74
30	25	300	2	117	1	39	50	45¢	45¢	H	25	M	None	40	125
300	119	300	50	30	.....	10	.....	40¢	....	PH	25	P	None	60	100
110	73	215	5	25	4	12	80	40¢	10¢	M	21	M	None	47	83
150	41	150	.....	150	.....	100	.....	30¢	3¢	H	50	M	.....	.....	.....
350	129	350	14	125	14	36	100	20¢	5¢	M	70	M	None	40	100
150	60	250	24	250	24	100	100	50¢	15¢	H	43	M	.....	52	.....
75	73	200	5	None	None	.....	.....	.....	.....	.....	38	M	.....	70	103
50	25	214	None	210	None	98	.....	67¢	....	M	27	M	.....	45	100
220	62	408	4	12	4	3	100	15¢	10¢	M	97	M	.....	55	100
50	37	300	6	25	2	8	33	.....	.....	M	25	M	None	45	110
400	98	900	5	None	None	.....	.....	.....	.....	.....	100	M	.....	50	100

Development of Asphaltic Oil Treatment for Old Bituminous Roads

By C. H. Lawrence
Maintenance Engineer, Trumbull County, Warren, Ohio

AS the result of extensive experimenting in this county, involving one hundred miles of roads, we have come to the conclusion that the life of a tar surface can be prolonged by the use of asphaltic oil. After the tar has lost all its value and is in the form of hard coke on the road surface, an asphalt treatment may be made with no fear of failure.

We did not hit upon the proper method and materials for this treatment right away. We spent some time experimenting with quantities and grades of materials and methods of application, and during 1923 struck a combination with which we are well satisfied.

During 1922 some forty miles of tar roads were treated with a comparatively light asphaltic oil, and slag passing a ¾-inch screen and retained on a ¼-inch screen. After thoroughly sweeping the surface, it was found necessary to do considerable cold-patch work before the oil could be applied. Two treatments, each consisting of ¼-gallon of road oil with a covering of slag, were then put on, using a total of between 15 and 25 pounds of slag per square yard, which was rolled with a 6-ton roller. Inspection of the 1922 work revealed that best results were secured where we had used 25 pounds of slag to the square yard, put on as stated above, and where traffic was kept off the completed surface for three or four days.

The results obtained during 1922, however, were not entirely satisfactory, because the oil was a little too light for the purpose, the slag being thrown from the road by traffic. Consequently, our program for 1923 provided for treatment of 60 miles of tar road, including a part of the mileage which was oiled the preceding year, with Texaco special macadam binder, which is a heavier product than the material used in 1922. Slag from ¼- to ¾-inch in size was spread at the rate of 25 to 30 pounds to the square yard, the average being 29 pounds.

About 3/10-gallon of the heavy oil at a temperature of 220 to 230 degrees Fahrenheit was applied to the square yard, followed by stone, and then a 6-ton tractor-drawn roller went over the surface, just setting the stone in the asphalt. The new surface is about ¾-inch thick and adheres perfectly to the old tar surface.

Although the 1922 oil did not give the best results when used in the first treatment of a tar surface, it may well be used the year following the treatment with the heavier oil. When applied at this time, ¼-gallon should be used to the square yard, covered with 15 pounds of ¼-inch stone. This treatment is in the nature of a seal coat.

The county is well pleased with the results obtained during 1923 and can safely recommend its method for the treatment of tar surfaces which have reached the end of their service.

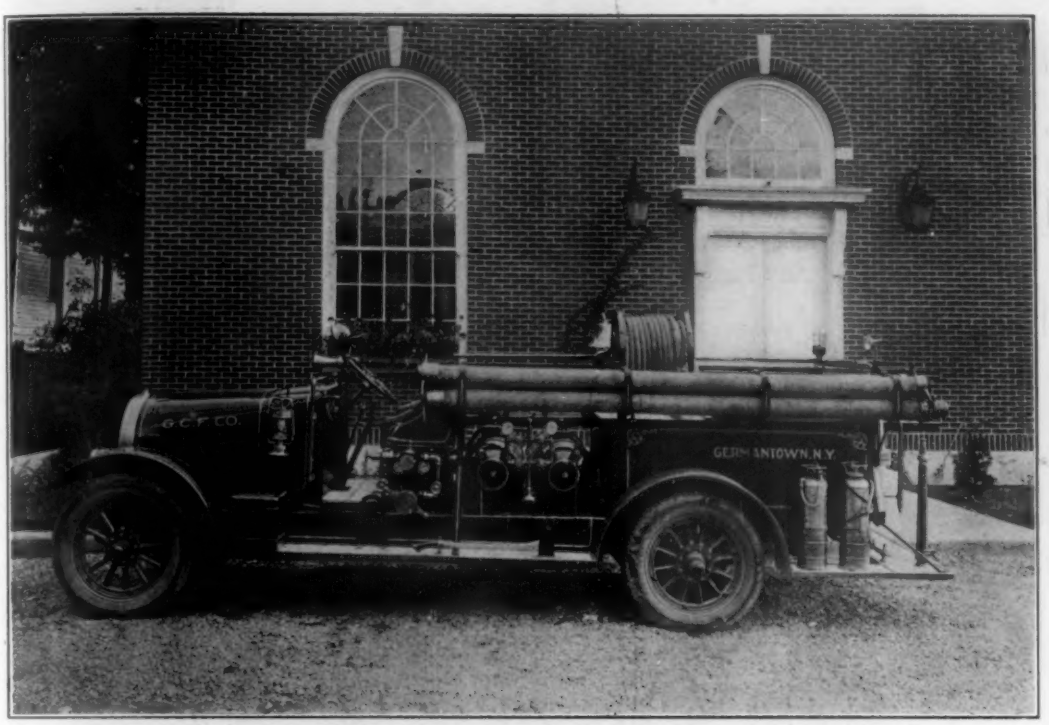
Penalty for Not Cleaning Snow from Pavements

THE city of Philadelphia has an ordinance on its books which states that it shall constitute and be a menace "to suffer or permit snow to remain more than six working hours after the same may cease to fall on any paved footway or gutter of the said city in front of or adjoining any church, public building, house, store, shop, stable or tenement of any kind or adjoining the side yard thereof, or vacant lots in any part of the city of Philadelphia, except rural or farming sections, where no sidewalks have been established; and the occupier or owner of such premises, if unoccupied, shall be liable for the penalty prescribed for such offense." The penalty is $5.

Financing Street-Lighting Improvements in Chattanooga

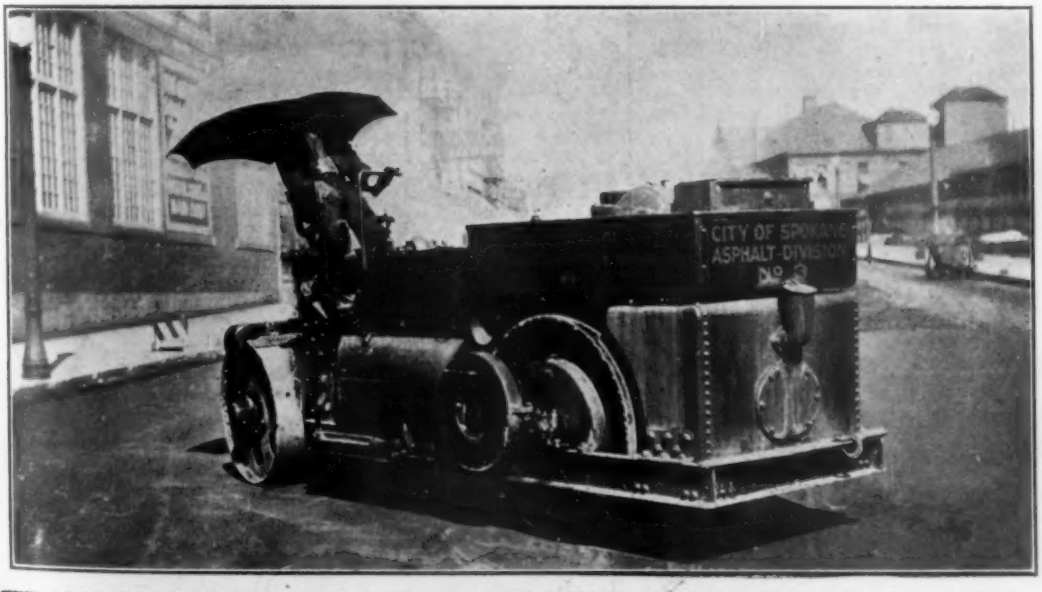
IN all new street-lighting installations in Chattanooga, Tenn., 1,500-candle-power lamps are used in G. E. Novalux units mounted on 14-foot ornamental posts, according to B. H. Martin, Illuminating Engineer, the Tennessee Electric Power Company, Chattanooga, Tenn. In the majority of the new installations the spacing is approximately 75 feet, which may vary 10 feet either way, depending upon the length of the block. All new installations are of the series system and are giving satisfactory results. The financing of installations is assumed by property owners, the total cost being prorated per front foot. At present there is under way one block which is costing property owners approximately $4.50 per front foot.

Municipal Motor Equipment in Service



NEW FIRE-TRUCK IN SERVICE AT GERMANTOWN, N. Y.

The new Childs truck depicted above has two 35-gallon steel chemical tanks, a pumping unit capable of delivering 350 gallons per minute at a pressure of 120 pounds, 200 feet of chemical hose, one 12-foot roof ladder, one 24-foot extension ladder, electric torches, spotlights, lanterns, bell, two fire extinguishers—one soda and acid, and one Foamite—as well as the usual equipment of axes, crowbars, pike poles and four lengths of suction hose



NEW 6-TON BUFFALO-SPRINGFIELD ASPHALT MOTOR ROLLER, FURNISHED TO THE ASPHALT DIVISION, SPOKANE, WASH., BY THE HOFIUS-FERRIS COMPANY OF THAT CITY

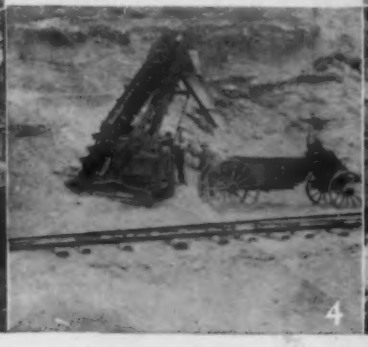
1—This Barber-Greene saved McGuire & Rolfe, Inc., $3000 last season, picking up excavation in Richmond, Va.

2—Working in close quarters at McGrady Bros., Pittsburgh, five yards of material were loaded in three minutes.

3—The street commissioner of Worcester, Mass., says his Barber-Greene snow loader takes the place of 100 men.

4—In the summer, Worcester, Mass., converts its snow loader into a bucket loader. It loads a gravel car in one-fourth the time eight men previously required.

5—The street commissioner of Worcester says his Barber-Greene Snow Loader takes the place of 100 men.



Builds streets in summer Clears them in winter

The Barber-Greene that saved the Springfield, Mass., Street Railway Company $1,200 in 3 days in a winter snow storm, replaces a gang of shovelers at handling gravel in the summer.

When winter is over, and the street paving season opens, the snow boom is jacked up and disconnected from the crawler chassis, and the bucket loader boom quickly attached. Transformed into a Barber-Greene Bucket Loader, it is ready to load scarified macadam, crushed rock, sand, ashes, and other bulk materials.

The City of Minneapolis uses two Barber-Greenes, with separate gangs, for paving in various parts of the city. It is estimated that each machine does the work of 12 laborers, at a considerable saving in time and money.

Mr. E. T. Gray, Superintendent of a street paving job in Yankton, S. D., writes about his Barber-Greene: "It can load a truck with 3 yards of dirt in the same time it takes 15 men with shovels to load a truck with one yard. In other words, a Barber-Greene will take the place of 45 men—some saving."

Cities large and small are finding the Barber-Greene a highly profitable investment. It is bringing them sure protection against those traffic delays and business losses that had always accompanied heavy snows. And on summer road work alone, in a single season, it often saves its cost.

Send for our two booklets, "Results on Road Jobs" and "Mechanical Snow Handling." They explain the methods used in all parts of the country to increase the speed and efficiency of street paving and snow removal. They will give you important pointers on your own summer and winter road problems.

BARBER-GREENE COMPANY—*Representatives in Fifty Cities*—515 W. Park Avenue, Aurora, Illinois

BARBER GREENE

Portable Belt Conveyors — Self Feeding Bucket Loaders

Automatic Ditch Diggers

Massachusetts Towns Provide Their Own Transportation

UNDER this heading the *Electric Railway Journal* published in its issue of January 10 an interesting account of how the towns of Athol, Orange, Greenfield and Montague have taken over and are now operating trolley lines abandoned by the original owners. The article says, in part:

"The first 'Transportation Area' formed under the statute passed by the State Legislature of Massachusetts in 1920 was created in March, 1924, from a portion of the Northern Massachusetts Street Railway. As shown in the accompanying map, the greater part of the trackage in the less-settled districts was abandoned and sold for junk. The most worth-while section was a route of 6.76 miles long between Athol (population 10,000) and Orange (population 5,400). This was purchased for $18,484 by the town of Athol following ratification by the voters on February 4, 1924. Operation by the board of trustees, comprising five members, was begun on March 24. The trustees have retained the cash fare of 10 cents and the token scheme whereby 12 tokens are sold for 50 cents, but with a minimum fare of two tokens for the first of the four zones.

"It is obvious from the price paid for the property that the trustees will not have to worry much about overhead charges, although the sale did not include power equipment, inasmuch as the railway had been purchasing power for some years in this hydro-electric territory.

"The second and more important transportation area had its inception on May 24, 1924, when the citizens of Greenfield (population 15,500) and Montague City (population 7,600) voted at special town meetings to purchase 8.7 miles of track with cars and repair facilities for $62,000 from the Connecticut Valley Street Railway. Of this sum, Greenfield paid $42,966 and Montague $19,034. Operation was begun on August 1. The Greenfield-Montague board has retained the fares of 10 cents cash and 12 tokens for 50 cents, with a minimum fare of two tokens in the initial zone of this four-zone system. At one time, tickets brought 30 per cent of the revenue, but owing to the decrease in steady riders this ratio has dropped to approximately 5 per cent.

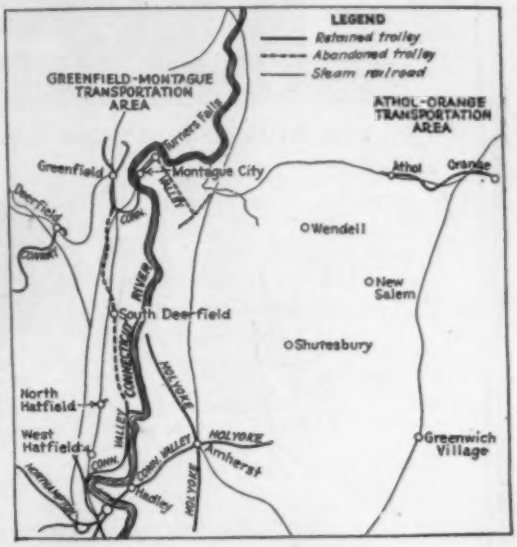
"In this case the receiver obtained a price somewhat better than that for scrap because the portion taken over showed an operating surplus in 1923 of about $12,000. In view of the small overhead charges, therefore, this transportation area has possibilities as a going concern.

Provisions of the Enabling Legislation

"The transportation area statutes of 1920, under which the Athol-Orange and Greenfield-Montague properties were taken over, provided for public operation of electric railways in districts where they could not be operated profitably any longer under private ownership.

"Section 143 states that one or more cities or towns may establish transportation areas for freight and passenger operation of street railways existing in their territory. With the approval of the voters, such a transportation area becomes a corporation vested with the rights and obligations under the general street railway laws that would apply to a privately owned railway, including regulation by the Department of Public Utilities. The law provides that the term 'Transportation Area' shall be included in the title.

"Another section states that a city, by vote of its council, subject to charter provisions, or a town by vote of its selectmen, may make preliminary agreements with one or more railway companies for lease or purchase and operation of the properties. Such preliminary agreements are



binding upon the company following due hearing by the department of public utilities, but subject to final acceptance by the voters. The department is responsible for the appraised value of the property, which shall be 'upon the basis of the actual value at the time of appraisal, and not on the cost of replacement.' Within 60 days after due advertisement of such a preliminary agreement and appraisal the voters are asked to decide if the agreement for public operation shall be accepted. If approved by a majority of the voters, the mayors, city councils and selectmen may proceed to the final agreement, subject to a few reservations made by the department of public utilities."

The article in the *Electric Railway Journal*, from which the foregoing quotations and the accompanying map are taken, gives information also regarding the powers of the boards of trustees, methods of financing, rates of fares, taxation, and other provisions of the enabling legislation.

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Time saved everywhere
Street space conserved
Traffic congestion reduced
Load evenly distributed
More space for pay load
Extraordinary durability

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Autocar Electric owned by Dist. of Columbia

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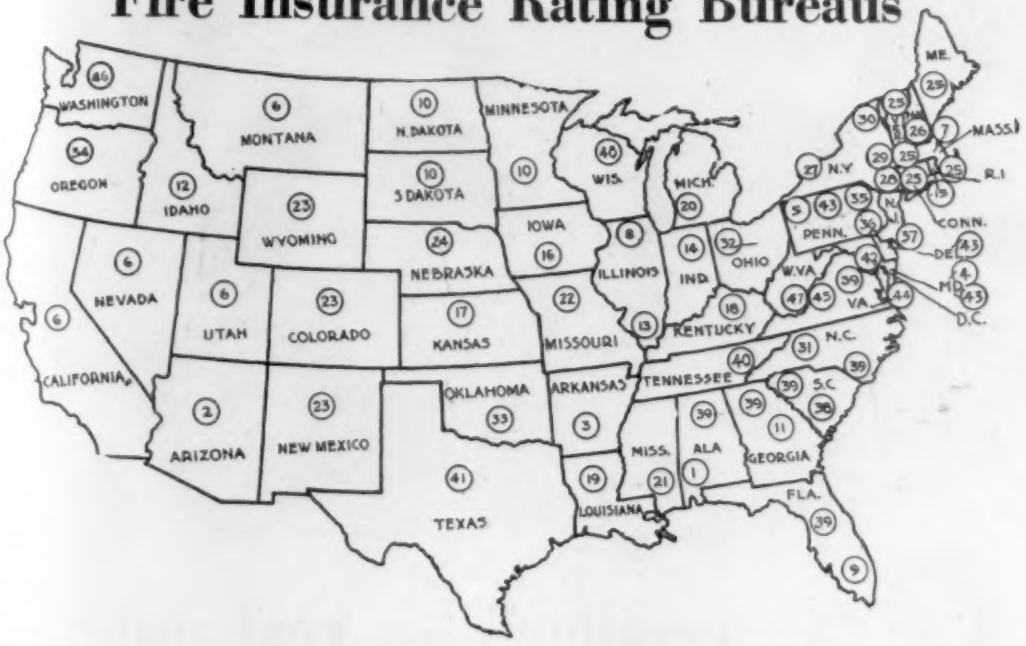

THERE has just been published (January, 1925) by Johnson & Higgins, average adjusters and insurance brokers, of New York, a large map of North America, printed in colors, on which is indicated the division of territory of the various fire insurance rating organizations. Because of the increasing interest which municipal officials and civic organizations are taking in securing lower insurance rates* for their respective cities, through improvements in building codes and in methods of fire protection and prevention, definite information is often desired as to the name and address of the rating bureau having jurisdiction in any given territory. To meet this need for readers of THE AMERICAN CITY, the accompanying list has been prepared of the rating organizations throughout the United States, together with a skeleton map to serve as a key. As will be seen, the names of the various bureaus are numbered in alphabetical order, and the corresponding numbers are inserted on the map in the state or states in which each bureau operates:

1. Alabama Inspection and Rating Bureau; L. P. Goodwin, Manager, Montgomery, Ala. Covers state of Alabama.
2. Arizona Equitable Rating Office; M. R. Colwell, Chief Surveyor, Phoenix, Ariz. Covers state of Arizona.
3. Arkansas Fire Prevention Bureau; T. F. Baker, Manager, Little Rock, Ark. Covers state of Arkansas.
4. Association of Fire Underwriters of Baltimore City; John H. Kenny, Secretary-Manager, 8-10 South Street, Baltimore, Md. Covers the city of Baltimore and five miles beyond corporate lines of city.
5. Board of Fire Underwriters of Allegheny County; R. J. Trimble, Secretary. Commonwealth Building, Philadelphia, Pa. Covers Allegheny County, Pa.
6. Board of Fire Underwriters of the Pacific; H. F. Badger, Jr., Secretary, San Francisco, Calif. Covers Montana, Utah, Nevada and California.
7. Boston Board of Fire Underwriters; Wm. H. Winkley, Manager, 40 Broad Street, Boston, Mass. Covers corporate city of Boston.
8. Chicago Board of Fire Underwriters; Ernest Palmer, Manager and General Counsel, Chicago, Ill. Covers city of Chicago and Cook County.
9. Florida Inspection and Rating Bureau; J. Hilton Holmes, Manager, Jacksonville, Fla. Covers state of Florida.
10. General Inspection Bureau; W. I. Fisher, Manager, Minneapolis, Minn. Covers Minnesota, North Dakota and South Dakota.
11. Georgia Inspection and Rating Bureau; Jos. S. Raine, Manager, Atlanta, Ga. Covers state of Georgia.
12. Idaho Surveying and Rating Bureau; J. H. Branscomb, Manager, Boise, Idaho. Covers state of Idaho.
13. Illinois Inspection Bureau; F. H. Jones, Publisher, Chicago, Ill. Covers state of Illinois, excepting Cook County and Chicago.
14. Indiana Inspection Bureau; E. M. Sellers, Manager, Indianapolis, Ind. Covers state of Indiana.
15. Insurance Association of Providence; Edw. Devine, Secretary, 42 Weybosset Street, Providence, R. I. Covers city of Providence.
16. Iowa Insurance Service Bureau; K. L. Walling, Publisher, Des Moines, Iowa. Covers state of Iowa.
17. Kansas Inspection Bureau; W. C. Hodges, Manager, Topeka, Kans. Covers state of Kansas.
18. Kentucky Actuarial Bureau; G. H. Parker, Manager, Louisville, Ky. Covers state of Kentucky.
19. Louisiana Fire Prevention Bureau; R. P. Strong, Secretary, New Orleans, La. Covers state of Louisiana.
20. Michigan Inspection Bureau; O. M. Henn, Manager, Detroit, Mich. Covers state of Michigan.
21. Mississippi State Rating Bureau; Lyle E. Osborne, Manager, Jackson, Miss. Covers state of Mississippi.
22. Missouri Inspection Bureau; Waterworth & Terry, Managers, St. Louis, Mo. Covers state of Missouri.
23. Montana State Inspection Bureau; L. H. Simonton, Manager, Denver, Colo. Covers states of Wyoming, Colorado and New Mexico.
24. Nebraska Inspection Bureau; Frank Stanberry, Publisher, Omaha, Nebr. Covers state of Nebraska.
25. New England Insurance Exchange; C. M. Goddard, Secretary, 18 Oliver Street, Boston, Mass. Covers states of Maine, Vermont, Connecticut, Massachusetts (except Boston), and Rhode Island (except Providence).
26. New Hampshire Board of Underwriters; L. Clarner, Jr., Secretary, Concord, N. H. Covers state of New Hampshire.

* An authoritative article on "How to Reduce Fire Insurance Rates," by H. A. Smith, President, National Fire Insurance Company, and Chairman, Insurance Advisory Committee, Chamber of Commerce of the United States, will be found in Section 3 of the 1925 *Municipal Index*. Other articles in this section include: "Decreasing the Fire Hazard," by Franklin H. Wentworth, Secretary, National Fire Protection Association; and "Increasing Efficiency in Fire Fighting," by W. E. Mallalieu, General Manager, The National Board of Fire Underwriters.

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Wherever you find "Caterpillars" at work, you find them delivering satisfaction, saving time and effecting real economies.

We'd like an opportunity to tell you how the "Caterpillar" will do the same for *your* community.

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27. New York Fire Insurance Rating Organization (Buffalo Division); E. H. Sigison, Manager, Marine National Bank Building, Buffalo, N. Y. Covers city of Buffalo, township of Wheatfield, town of Tonawanda, North Tonawanda, and Kenmore.

28. New York Fire Insurance Rating Organization (New York City Division); E. R. Hardy, Assistant Manager, 123 William Street, New York City. Covers boroughs of Manhattan, Bronx (west of Bronx River), and Brooklyn, Long Island City, and American docks and stores in Richmond.

29. New York Fire Insurance Rating Organization (Suburban Division); W. J. Ward, Deputy Manager, 123 William Street, New York City. Covers Long Island and Staten Island (except as noted above), Borough of Bronx (east of Bronx River), Westchester, Putnam and Rockland Counties.

30. New York Fire Insurance Rating Organization (Syracuse Division); F. W. Jenness, Secretary, 700 Gurney Building, Syracuse, N. Y. Covers New York State (except territory of New York, suburban and Buffalo divisions).

31. North Carolina Inspection and Rating Bureau; Paul B. Hulfish, Manager, Raleigh, N. C. Covers state of North Carolina.

32. Ohio Inspection Bureau; T. B. Sellers, Manager, Columbus, Ohio. Covers state of Ohio.

33. Oklahoma Inspection Bureau; C. T. Ingalls, Manager, Oklahoma City, Okla. Covers state of Oklahoma.

34. Oregon Insurance Rating Bureau; James N. McCune, Proprietor, Portland, Ore. Covers state of Oregon.

35. Philadelphia Fire Underwriters' Association; C. A. Hexamer, Secretary, 131-141 South Fourth Street, Philadelphia, Pa. Covers city of Philadelphia.

36. Philadelphia Suburban Underwriters' Association; A. P. Stradling, Secretary, 331 Walnut Street, Philadelphia, Pa. Covers Bucks, Chester, Delaware and Montgomery Counties.

37. The Schedule Rating Office of New Jersey; Leon A. Watson, Expert. 31 Clinton Street, Newark, N. J. Covers state of New Jersey.

38. South Carolina Inspection and Rating Bureau; Jas. R. Parker, Manager, Columbia, S. C. Covers state of South Carolina.

39. Southeastern Underwriters' Association; W. F. Dunbar, Manager, Jos. S. Raine, Secretary, Atlanta, Ga. Covers states of North Carolina, South Carolina, Georgia Florida, Alabama and Virginia.

40. Tennessee Inspection Bureau; F. B. Quackenbush, Manager, Nashville, Tenn. Covers state of Tennessee.

41. Texas State Fire Insurance Commission; John M. Scott, Chairman, Austin, Tex. Covers state of Texas.

42. Underwriters Association of the District of Columbia; E. R. Hardy, Manager; H. E. C. Rainey, Acting Assistant Manager; Woodward Building, Washington, D. C. Covers District of Columbia.

43. Underwriters Association of the Middle Department; Louis Wiederhold, Jr., Secretary, 414 Walnut Street, Philadelphia, Pa. Covers state of Pennsylvania (except Philadelphia and Bucks, Chester, Delaware, Montgomery and Allegheny Counties), states of Delaware and Maryland (except Baltimore, Md.).

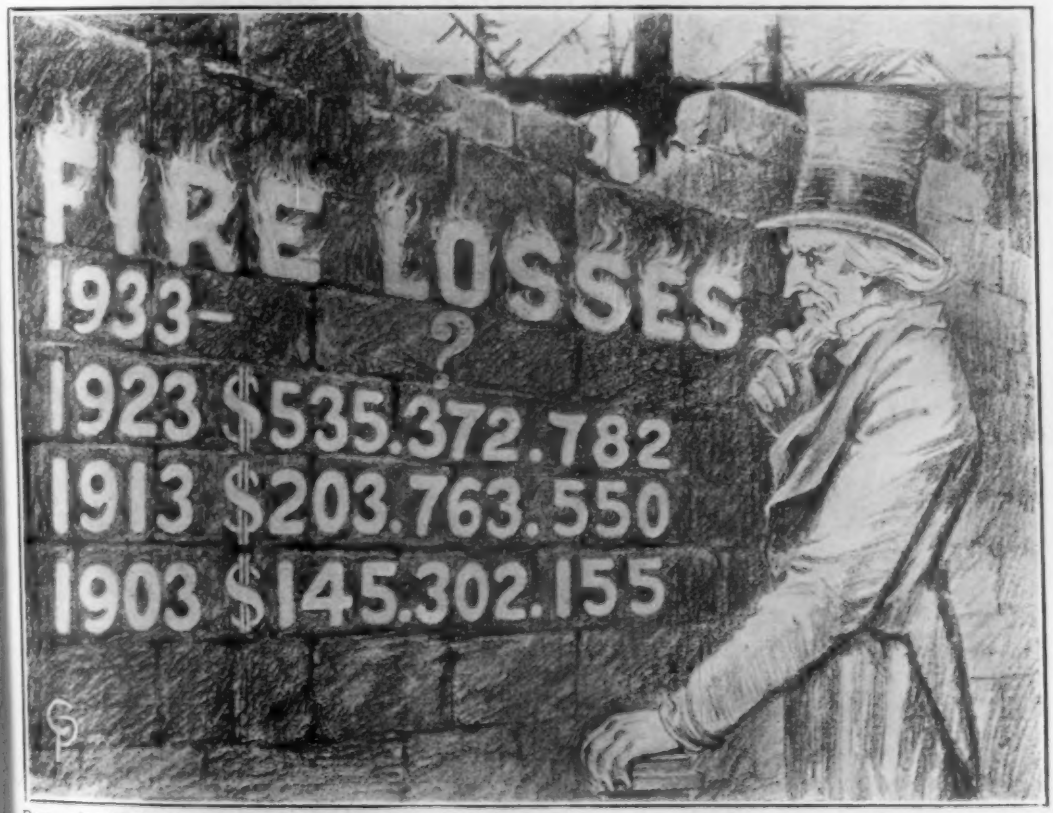
44. Underwriters Inspection Bureau; W. S. Selby, District Manager, McKevitt Building, Norfolk, Va. Covers city of Norfolk.

45. Virginia Inspection and Rating Bureau; E. W. Spencer, Manager, Richmond, Va. Covers state of Virginia (except Norfolk).

46. Washington Surveying and Rating Bureau; Lee McKenzie, Proprietor, Seattle, Wash. Covers state of Washington.

47. West Virginia Inspection Bureau (under jurisdiction of Ohio Inspection Bureau); T. B. Sellers, Manager, Columbus, Ohio. Covers state of West Virginia.

48. Wisconsin Inspection Bureau; Geo. E. Nichols, Manager, Milwaukee, Wis. Covers state of Wisconsin.



Drawn for "Safeguarding America Against Fire," by Curtis Perry

FOR AN ANALYSIS OF THE PRINCIPAL CAUSES OF FIRES IN THE UNITED STATES, SEE THE 1924 AND 1925 VOLUMES OF THE MUNICIPAL INDEX

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THE dependable precision of Tarvia delivery service is often commented on. Yet it is a fact that but few Tarvia enthusiasts realize the volume and character of the equipment that makes this service possible.

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Interesting Features of Los Angeles' New Traffic Ordinance

By Miller McClintock

Traffic Consultant to the City Council and the Traffic Commission of Los Angeles

THE complicated traffic code with which Los Angeles has been struggling for many years was replaced on January 24 by a new and simplified system of regulations involving a number of interesting features.

As a preliminary to the formulation of the new traffic regulations, extensive surveys and traffic counts were made throughout the entire city. On the basis of the data thus collected, the new rules were formulated. They include many of the principles which were brought out at the recent National Conference on Street and Highway Safety.

The traffic situation in Los Angeles is particularly pressing because of the large number of automobiles owned—the ratio at present being 2.5 persons per car—and, in addition, because of the favorable climatic conditions which make daily driving a regular practice.

The new regulations include a number of innovations for the control and protection of pedestrian traffic. Jay-walking is prohibited in the Central Traffic District and in outlying business districts. The police are required to place crosswalks in these districts, and pedestrians, when using crosswalks, are given the right of way over motor vehicles.

Vehicles are forbidden to drive into safety zones at car stops and elsewhere under any conditions.

Pedestrians are required to give obedience to traffic signals.

Special school crossings are provided by yellow-paint line lanes at intersections in the vicinity of public schools, and motorists are warned of these crossings by arrows placed on the pavement near the crosswalks. Drivers of motor vehicles are forbidden to enter a school crossing when the right half is occupied by a pedestrian. This regulation has already proved its value by a material increase in the safety of school children.

None of the traffic regulations is enforceable in the city unless suitable signs have been erected by the police.

Special regulations regarding parking and driving in business districts are rendered flexible by the authorization given to the police department to establish a business district in any block in the city where 50 per cent or more of the frontage is used for business purposes.

Right- and left-hand turns are prohibited unless the vehicle is in the line of traffic nearest the right curb or the center of the roadway respectively.

All alleys in the Central Traffic District are made one-way thoroughfares. Vehicles are required to come to a complete stop immediately before crossing sidewalks when leaving alleys or driveways at any place in the city.

Certain classes of heavy freight vehicles are excluded from the Central Traffic District during the daylight hours.

Horse-drawn vehicles are prohibited from entering the congested district between the hours of 4:30 and 6 P. M.

Eight streets have been designated as Boulevard Stop streets, and vehicles are required to come to a complete stop before entering such streets.

Vehicles are prohibited from following fire apparatus closer than one block, and from parking in any block where fire apparatus has stopped in answering an alarm.

A color scheme has been devised for the indication of parking provisions: At curbs painted red, vehicles are forbidden to stand except at the direction of the officer or to avoid collision. Curbs with yellow lines indicate loading zones where vehicles may be stopped only long enough to load or unload passengers or merchandise. These loading zones will take from one-quarter to one-half of the curb space in the congested districts.

Parking is limited to 45 minutes from 7 A. M. to 4:30 P. M., but from 4:30 to 6 P. M. all parking is prohibited in the Central District.

A new provision has been designed for vehicles passing street cars. Vehicles are forbidden to pass any moving street car within 100 feet of an intersection being approached. Vehicles must be stopped to the rear of the nearest door of any street car loading or unloading passengers, but vehicles so stopped

Ford Ton Truck Cuts Street Sprinkling Costs in Half

For street sprinkling, the City of Newman, Calif., uses a tank mounted on a Ford Ton Truck.

The capacity of the tank is 500 gallons and the cost of emptying the full load in sprinkling is only 11c. This, compared with a cost of 22c per load when horses were used, proves the economy of Ford Products in Municipal Service.

S. H. Tennin, chairman of the Board of Trustees, commenting on this improvement in street department service says: "In the summer time, the tank is filled and emptied 40 times each day in a working period of six hours. The average mileage is forty miles.

"The reduction of 50% in operating cost enables us to make a very handsome saving. This is in addition to the money saved on the upkeep of the truck as compared with the maintenance cost of horses and wagon."

Let your nearest Authorized Ford Dealer demonstrate how Ford Products can save you time, labor and money.

Ford One Ton Chassis, $365 f.o.b. Detroit

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may proceed cautiously if there is a marked safety zone at the car stop; otherwise, they must remain standing until the street car has moved on.

The ordinance provides for the establishment of a street traffic fund into which all fines, forfeitures and penalties collected under the traffic ordinance can be placed, and from which the Council is authorized to appropriate the money for the purchase and maintenance of traffic devices.

EDITORIAL NOTE.—The full text of the Los Angeles ordinance, or a digest of it in card form, can be obtained by any one interested, by writing to the Traffic Commission.

Kansas City Adopts City Manager Plan

By Walter Matscheck
Director, Kansas City Public Service Institute

ON February 24, Kansas City, Mo., adopted a new charter providing for the council-manager plan of government. The successful outcome of the election was the result of several years of effort and educational work. This included two previous charters submitted to the people, one of which was a hybrid manager charter, and amendment of the state constitution to permit a manager charter.

The charter contains most of the standard features of council-manager charters, with a few differences. A council of nine members is provided. Four members are elected from districts and four are elected at large. Not more than one of those elected at large may live in the same district. The mayor is the ninth member.

The mayor is elected as mayor and is given a salary of $5,000 a year. In several ways the office of mayor is made more prominent and provided. Four members are elected from disager charters. He is given a higher salary. He has power to require reconsideration of the vote on any ordinance passed by the council. He appoints the city plan commission, the art commission and the park board.

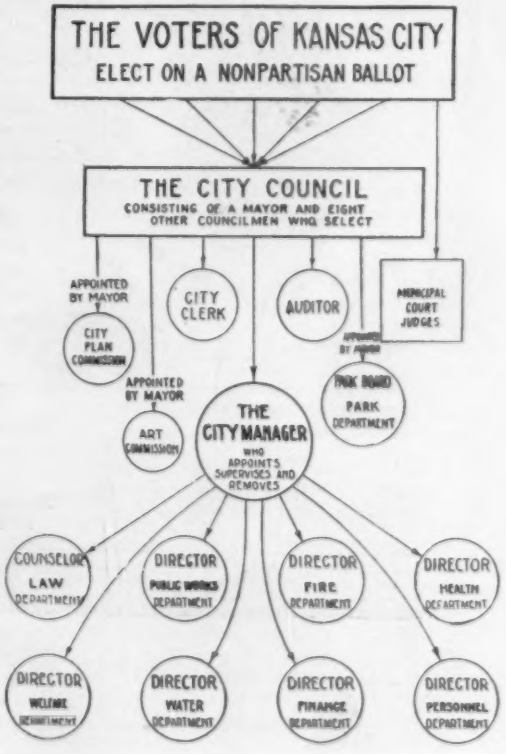
The mayor and council are elected on the ordinary non-partisan ballot. It is believed that proportional representation is of doubtful constitutionality in Missouri.

There are the regular provisions about the city manager and the administrative departments. All departments, except the park department, are under the city manager. Because of local sentiment, the park department was continued under a board appointed by the mayor.

There is a departure from the standard provisions in the personnel department. Instead of the regular civil service, the general idea of an employment department was followed. Examination before appointment is required as usual, but the appointing officer may appoint to a position any one on the eligible list for the position. There is no restriction on discharge, except that the discharged person may ask for a review by the city manager.

Compared with Kansas City's present government with its two-house council, its elective mayor as the chief executive officer, its other elective administrative officers, and its system of administrative boards, the new charter is almost a complete change.

The first election on the new charter will be held in November of this year, and the charter will take effect April 10, 1926. This will give the new council ample time to make plans for reorganization of administrative machinery, to select a manager, and make preliminary adjustments before taking office.



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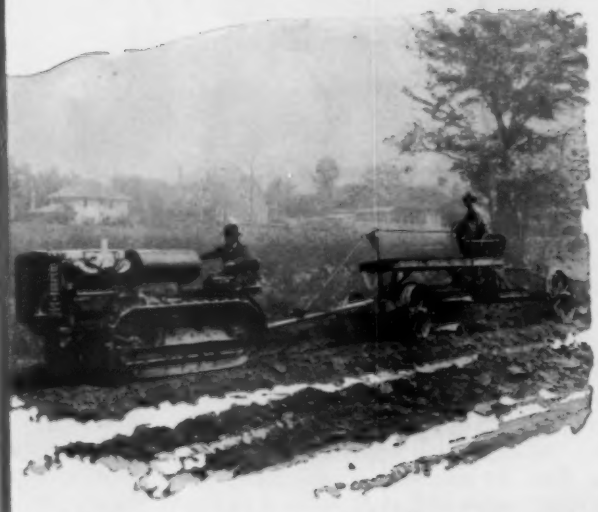

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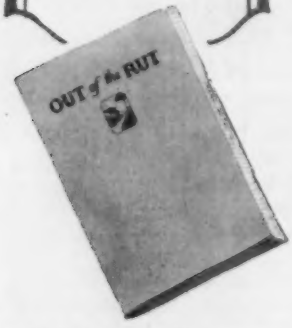
Perhaps the people near you who own Best Tractors do not know **what makes their machines work for so many years with so little wear, but they can tell you a story of service worth hearing.** Send for a list of nearby owners if you do not know them.



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Hints, Helps and Happenings

Parking Within a City Block

CITIES with level topography may meet the continually increasing demand for more street space for traffic and parking by more or less expensive widenings. Even in level cities, however, the economical cut-back limit is soon reached and the parked car must give way to moving traffic.

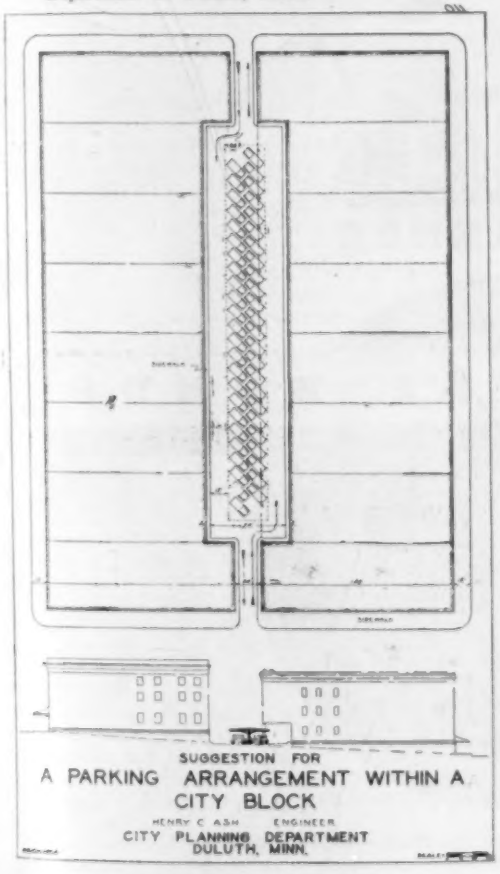
In cities such as Duluth, whose avenues run up steep hillsides and are already near the grade limit, extensive widening cannot be considered, even though the expense is not excessive, for the reason that each foot of widening adds to the grade difficulties of the cross-streets.

The possibility of a more economical arrangement for parking cars and leaving the streets free for moving traffic is shown in the accompanying cut. Such an improvement might be made by the municipality, but more properly perhaps by mutual agreement among the owners of any single block.

With well-arranged rear entrances, the convenience and attractiveness of this plan, especially to women shoppers, are readily understood.

H. C. ASH,

Executive Secretary and Engineer, City Planning Department of Duluth, Minn.



Augusta's Experiment in Reducing Freight Rates

WITH the reversal by the Georgia Court of Appeals of an injunction secured by certain citizens of Augusta against the purchase of a freight boat by that city, the way has been cleared for a unique experiment in reducing freight rates.

Some weeks ago the city of Augusta decided to purchase a freight boat or barge to ply between Augusta and Savannah on the Savannah River. The river is navigable as far as Augusta, and the city officials thought they saw in such a boat a chance to secure freight for the city proper, and for local merchants and dealers, at water rates from Savannah.

A special committee appointed for the purpose reported favorably on the idea, the City Council voted to purchase the craft, Mayor Julian M. Smith affixed his official O.K. on the proposition, and all looked well.

Then three citizens of Augusta went before the local courts and secured an injunction against the purchase of the boat on the ground that the city's charter did not authorize it to make any such purchase. It is this injunction which has now been reversed by the Georgia Court of Appeals.

The boat will be purchased from a fund of $74,000 in the city treasury in executions for unpaid taxes. The experiment will be worth watching, for, if it works as expected, it may stimulate the return of water transportation in the South, and lead to the operation of other city-owned boats and barges for the benefit of local merchants and dealers.

A Tri-State Study of Highway and Traffic Problems

AT a meeting held in Philadelphia in January, under the leadership of the Committee on Regional Plan of the Philadelphia Metropolitan District, it was voted to request the Governors of Pennsylvania, New Jersey and Delaware, and the Mayors of Camden and Philadelphia, to instruct the Highway Departments within their jurisdiction to assemble the results of studies which had been made and to make such additional studies as may seem desirable of the highway and traffic problems in the three states and the two cities, with particular reference to their relationship to the other parts of the metropolitan area.

The meeting was attended by the members of the Philadelphia Regional Planning Committee, the Chief Engineers of the Highway Departments of Pennsylvania, New Jersey and Delaware, together with a number of members of their staffs; by several city officials, including the Consulting Engineer of Philadelphia, the City Architect and the head of the Bureau of Highways; by the Chairman of the Mayor's Traffic Commission, and by other engineers, architects and citizens interested in metropolitan regional problems. The programs of the various cities for highway development

Paving Offers Many a Chance for Short-Sighted Economy—

THERE'S a city in Illinois which, eight years ago, had an important paving decision to make. 40,000 yards of paving was to be laid. Brick was not used. For "economy's" sake a "cheaper" substitute was used.

The paving bonds on that job are not yet paid off but the pavements are worn out. Some of them went to pieces in the first five years.

Close by in neighboring cities are brick pavements from twenty-five to thirty-three years old, and numerous brick pavements that are still "young" after fifteen to twenty years of service.

Bonds pay for pavements but taxes pay for the bonds.

Be sure that the pavements your community gets will outlast the bonds. Don't let it be fooled by the bait of "cheap" first cost.

VITRIFIED
Brick
PAVEMENTS

OUTLAST THE BONDS

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION, ENGINEERS BLDG., CLEVELAND, OHIO

were presented, and almost every speaker emphasized the fact that the highway development in each of the states within a thirty-mile radius of Philadelphia was in reality a part of a single metropolitan problem, and that the various programs must be developed with a definite relation to one another. It was urged repeatedly that a unified study and solution of the problems is essential.

The meeting brought out particularly the importance of the development of a circumferential route about the cities of Philadelphia and Camden, in order that as much as possible of "through traffic" be enabled to avoid the down-town congested centers. It was suggested at this meeting that the opening of the new Delaware Bridge will attract a vast amount of through traffic and will serve to increase the already congested districts of Philadelphia and Camden.

Endorsement of this proposal for a tri-state study of highway and traffic problems has already been given by the Governors of the three states and by Mayor Kendrick of Philadelphia. The Chief Engineers of the three State Highway Departments have urged immediate inauguration of the survey, and it is believed that a definite program of procedure will soon be outlined.

Chicago's Juvenile Court Celebrates

THERE was held in Chicago last week a celebration of the twenty-fifth anniversary of the establishment of the first juvenile court. Among the prominent figures at this silver wedding of judicial procedure and intelligent sympathy were: Mrs. Joseph T. Bowen, head of the original committee which secured the establishment of the court; Judge Mack, the second judge assigned to a court which specialized in juvenile cases; Judge Ben Lindsay of Denver, whose service in that field has been so long and so notable that he is entitled to rank among the pioneers of the movement; Dr. Miriam Van Waters of the Los Angeles court; together with Judge Victor Arnold and Judge Mary Bartelme, the present judges of the Chicago Juvenile Court.

It is a curious revelation of the slowness of the process by which elementary common sense gets embodied in legal practice that, through all the centuries during which malefactors and delinquents have been brought before the bar of justice for correction or punishment, until so recently it never occurred to any one that the cases of minors could be more effectively handled in courts which had no other business. There had been special admiralty courts for generations. There had on occasion been special courts for certain kinds of cases involving land grants. But an adolescent boy who had gotten out of hand or a young girl who had gone wrong had to take their chances in general criminal courts in which the procedure and the personnel were adapted to hardened and adult criminals. Doubtless it was the rising interest in scientific child-study and in the psychological basis of education that suggested that the cases of delinquent children should be handled by judges who not only knew something about law and something about crime but also knew something about children and who had an attitude toward juvenile delinquents different from that which is proper toward experienced burglars and murderers.

The experiment has been successful in the highest degree. The work of Judge Lindsay has deservedly gained nation-wide renown. Perhaps, since the celebration was held at Chicago, where the movement originated, it may not be invidious to mention also the wise and efficient service of Judge Bartelme, who, after a long period as an assistant to the Judge of the Juvenile Court, a year or more ago became a full-fledged judge, and to whom are assigned the cases of delinquent girls.

There is much yet to be learned about the handling of juvenile delinquency, and much that has been learned is yet to be put in practice. It is, for example, more than doubtful whether the best results are obtained by sending such cases to special institutions, where the best speedily learn all that is known by the worst and become fired with an ambition to acquire all the experiences that they hear described by those of their associates who have gone farthest along the wrong road. But the establishment of juvenile courts, with separate departments for boys and girls, is all clear gain.

—*The Christian Century* for January 22, 1925.

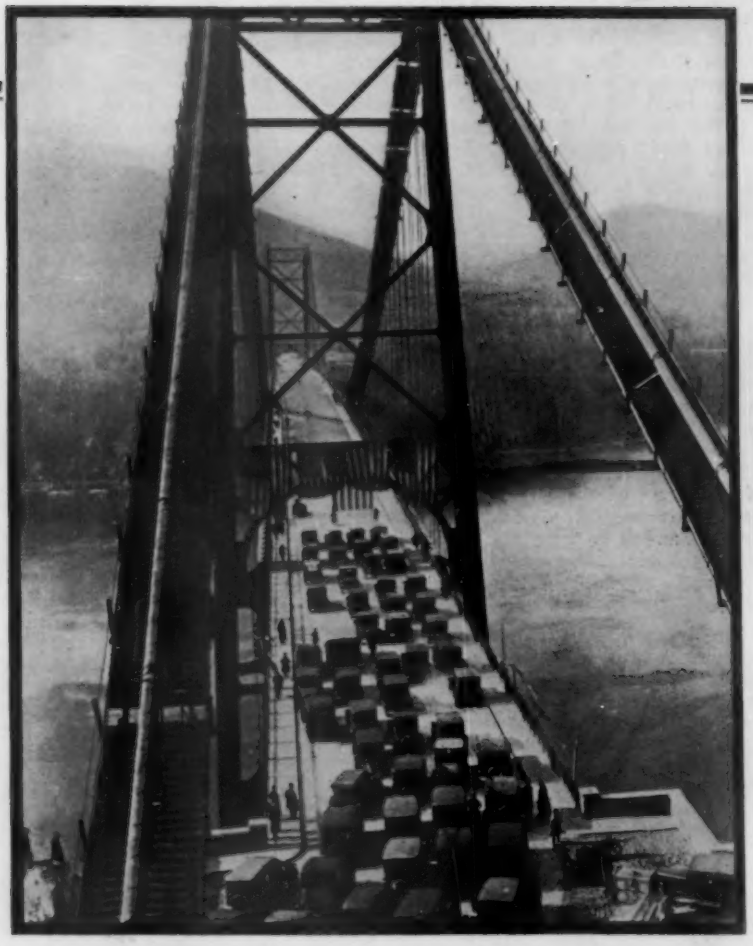
Who puts the "mock" in democracy? Two kinds of people: first, the gang element who are kinds of people: First, the gang element who are "in it for what there is in it" for them; secondly, the non-voters and shirkers who forget to register or fail to vote. Of these two forces, the indifferent voters are the more dangerous, because the gangsters would soon disappear if the majority of citizens always exercised their right to vote.—The Civic Searchlight, Detroit.

Will the Approach to the New City Hall Look Like This?

THIS CARTOON WAS USED BY THE BUFFALO CITY PLANNING ASSOCIATION ON THE FRONT COVER OF A RECENT ISSUE OF "CITY FACTS," TO AROUSE PUBLIC SENTIMENT AGAINST ADVERTISING SIGNS WHICH PROJECT OVER THE SIDEWALKS OR OTHERWISE ENCROACH UPON PUBLIC PROPERTY

BEAR MOUNTAIN BRIDGE

This great bridge across the Hudson River—the longest completed suspension span in the world—is a Bermudez Asphaltic Concrete highway. Photograph shows the procession of motor cars starting across the bridge during the opening ceremonies recently.



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The Municipal Bond Market

By Sanders Shanks, Jr.

Editor, *The Bond Buyer*

FOLLOWING a recession in prices and the issuance of a large volume of new state and city bonds in January, the municipal bond situation changed abruptly in February. New offerings fell off sharply during the first half of the month and, with dealers virtually sold out of bonds previously issued, the market became unusually firm and prices advanced sharply. The explanation of the splendid showing the municipal market has been making is found in the steady absorption of bonds by savings banks, insurance companies and institutions of similar character. Heretofore, the supply of attractive mortgage loans was such that it was not necessary for these buyers to turn to the bond market, and what bond buying they did do was limited to the occasional "bargains" brought to their attention. Now the money is piling up and they find a growing scarcity of mortgages of the better class. The result is a growing and strong inquiry for "legal" and other state and municipal obligations of the better grades.

The following list of important issues sold in February indicates the rates at which municipalities have recently arranged loans:

Amount	Borrower	Maturity	Interest Rate (%)	Net Interest Cost (%)
$ 670,000	Cheltenham Tp., Pa., Sch. Dist..	1935-55	4¼	4.02
700,000	Cattaraugus Co., N. Y.....	1930-43	4¼	4.10
5,000,000	West Virginia.....	1931-50	4 & 4½	4.12
3,000,000	Chicago, Ill., Sanitary Dist.....	1927-45	4	4.14
900,000	Richmond, Va.....	1926-34	4½	4.20
500,000	Dayton, O.....	1926-50	4½	4.24
1,000,000	Kansas City, Mo., Sch. Dist.....	1941	5	4.29
400,000	Fond du Lac, Wis.	1925-44	4½	4.33
1,350,000	Spartanburg, S. C.	1930-65	4½	4.42
750,000	Pasadena School Dist., Cal.....	1926-54	4¾	4.43
1,000,000	Hillsborough Co., Fla., Cons. Spc. Tax Sch. Dist. No. 4.....	1927-51	5	4.66
500,000	Randolph Co., N. C.	1944-53	4¾	4.68
704,015	Lima, O.....	1927-51	5	4.90

Red Cross Organization Changes

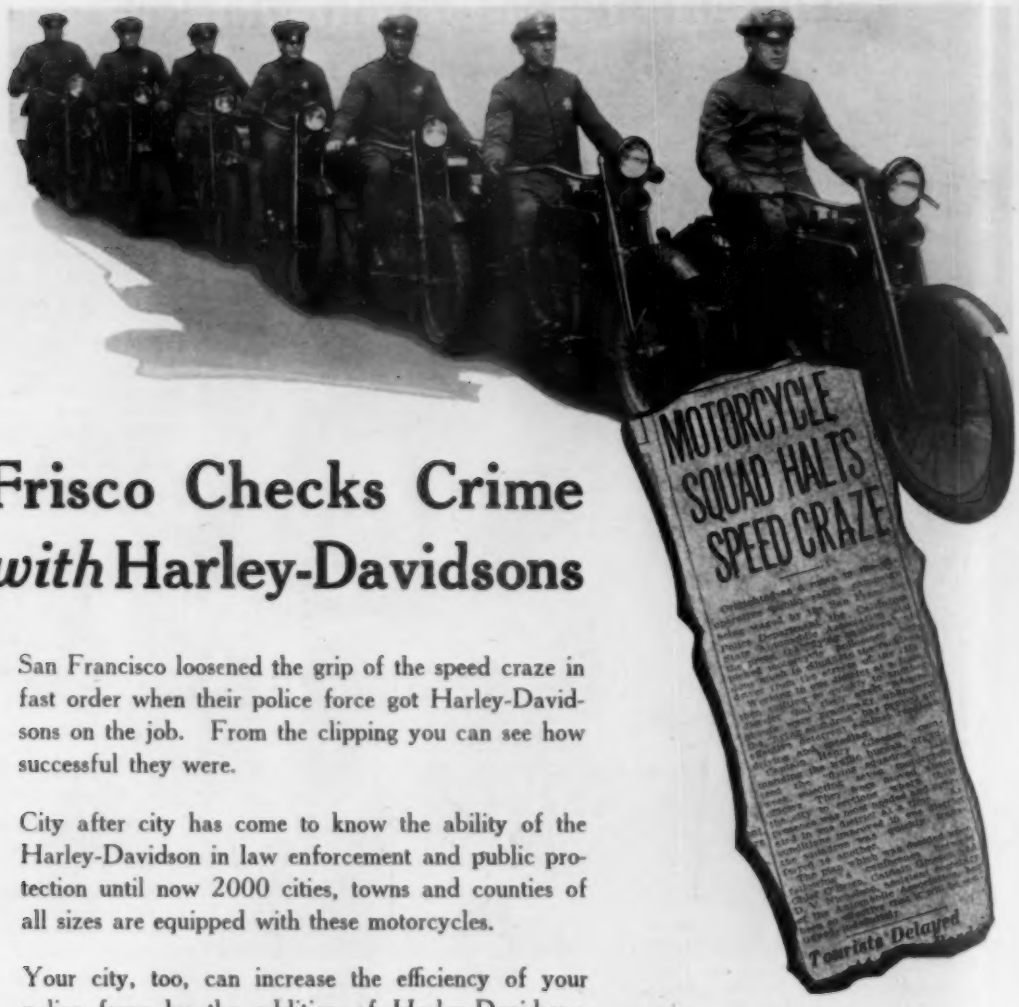
By James L. Fieser

Vice-Chairman, The American Red Cross

EFFECTIVE February 16, 1925, the American National Red Cross has put into operation a plan of organization eliminating the six division offices which have been maintained with headquarters at Boston, Washington, Atlanta, Chicago, St. Louis, and San Francisco. The division offices have been patterned after the National Headquarters organization at Washington, and have been maintained for the purpose of forwarding the great program of humanitarian work throughout the United States. The peace-time operations of the Red Cross have now become stabilized to the extent that the question of distance from the administrative office is not as important a factor as it was during the war. However, offices will still be maintained at St. Louis and at San Francisco, but they will be merely branches of the National Headquarters continued as a matter of convenience because of the distances involved.

It may appear that in this action the Red Cross is centralizing, whereas the general policy of large organizations to-day is to decentralize. The fact is that the Red Cross organization is completely decentralized for the reason that the unit of organization is the local chapter, and there are in the United States more Red Cross chapters than there are counties. The chapters and their branches are not affected by this new order; in fact, the abolition of the divisions makes for a more direct contact between the unit or chapter and the National Headquarters. There is, of course, just one Red Cross in the United States, and it embraces the chapter and the national staffs alike. The field staff remains intact and will be strengthened. The disaster-relief operations will have the additional services of a constant advisory staff of specialists both at National Headquarters and in the branch offices. The San Francisco office will continue to deal with the states included in the former Pacific Division, and the St. Louis office will deal with the states which have been embraced in the Central and Southwestern Divisions. National Headquarters will deal directly with all states that were included in the Washington, New England, and Southern Divisions. The national personnel, including the representatives in the branch offices, will increasingly act as a single unit with a uniformity of method not hitherto possible. These changes are merely a simplification of organization to meet the needs of normal times. The new adjustments will bring about economy and at the same time increase administrative control and responsibility over the entire national forces.

The primary purpose of the American Red Cross is to preserve those peculiar interests which are found in no other national movement outside the Government, and which are defined in the National Charter of the organization. It is the one voluntary arm of the American Government in times of great emergencies. As such, it must preserve its national entity. Its freedom from special interest other than humanitarian service makes it increasingly important that the experience of its officers and members be more closely recorded through the national organization. The work in the chapters has continued steadily as a public service, and tremendous local, national, and international emergencies have been met by the Red Cross without undue strain.



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Your city, too, can increase the efficiency of your police force by the addition of Harley-Davidsons. And they cost so little to operate—50 miles for a dollar, and that includes gas, oil, tires, everything.

Write for interesting special police literature showing just how other cities are improving police protection with Harley-Davidsons.

HARLEY-DAVIDSON MOTOR CO.
Dept. M Milwaukee, Wis.

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Trim stream-line design. More power. More speed. Larger tanks. Easier riding. Alemite lubrication. *Lower prices.*

Harley-Davidson
The Motorcycle

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Conducted by A. L. H. Street, Attorney at Law

Limitations on Municipal Power to Contract

MUNICIPAL corporations, unlike individuals, are narrowly limited in their power to make self-binding agreements. And, under fundamental rules, where they fail to bind themselves they do not bind the other party.

If a given contract has no legitimate relation to the objects for which the corporation exists, it is void. In one of the latest decisions on this subject, the Texas Supreme Court decided that defendant city could not disregard provisions of its charter and issue notes maturing annually in payment for land acquired for cemetery purposes. The Court said:

"It is a general and undisputed proposition of law that a municipal corporation possesses and can exercise the following powers, and no others: first, those granted in express words; second, those necessarily or fairly implied in, or incident to, the powers expressly granted; third, those essential to the accomplishment of the declared objects and purposes of the corporation—not simply convenient, but indispensable. Any fair, reasonable, substantial doubt concerning the existence of power is resolved by the courts against the corporation, and the power is denied. Of every municipal corporation, the charter or statute by which it is created is its organic act. Neither the corporation nor its officers can do any act, or make any contract, or incur any liability, not authorized thereby, or by some legislative act applicable thereto. All acts beyond the scope of the powers granted are void." (Foster vs. City of Waco, 255 Southwestern Reporter, 1104.)

In another comparatively recent case (Alaska Electric Light & Power Company vs. City of Juneau, 294 Federal Reporter, 864), it was decided that defendant city was not empowered to fix for a definite term rates chargeable by plaintiff. It appeared that an act of Congress empowered Alaskan municipalities to provide for lighting, but the United States Circuit Court of Appeals, Ninth Circuit, said:

"Power granted to a municipality to provide for water-supply and lights undoubtedly carries with it the power to grant a franchise to an electric light company for a limited period of time to use the municipal streets for poles and wires and the transmission of electricity, and the franchise, if accepted, becomes binding upon the city and the company, not to be revoked or repealed, unless the power to repeal has been clearly and unmistakably reserved. . . . But this is far from saying that there is necessarily included, in the power to provide lights for a city, the power to enter into a binding contract whereby the rates to be charged by a public utility corporation shall be irrevocably fixed."

But, not long ago, the Supreme Court of Georgia recognized that, where the power to contract is conferred, a broad discretion will be allowed the municipal authorities. The Court said (Mayer vs. Faver, 117 Southeastern Reporter, 653):

"The mayor and council of Washington, being expressly authorized by its charter, in their discretion, to pave its streets, have, in this respect, the power to make all contracts which natural persons could make. . . . A municipal corporation, unless restricted by its charter, has power to enter into any necessary contract for the accomplishment of a corporate purpose. . . . Being empowered to pave and to contract for paving the streets of this city, such power necessarily implies the right to do all things which may be required for the proper exercise of such power. . . . We do not think that the city council would have to make a direct contract with some one for such paving. Being authorized to make all proper contracts for this purpose, the city council can make indirect contracts for the accomplishment of this purpose. They could make a contract to do the paving, and such a contract would be valid under their general powers to contract for the pavement of the streets of that city. We see no valid reason why the city of Washington could not make an arrangement with the State Highway Department and the Commissioners of Wilkes County, whereby the county could contract for doing this paving, and be paid therefor with federal funds advanced for that purpose and out of assessments to be levied by the city under its charter power to pave its streets and levy one-half of the cost against the lots of abutting owners."

In the case of People vs. Dibble, 189 New York Supplement, 29, a New York court ruled that, for lack of statutory or charter authority, the city of Schenectady could not validly contract for insurance on the lives of employees of the city in general, for their benefit. The opinion in that case says:

"If this system of insurance may be upheld, there is no reason why the city may not hire the houses for its employees, provide for their clothing, while in the employment of the city, or make

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THERE are four sizes of Novo Two-in-One Combination Hoist and Compressor Outfits. The one shown above is a reproduction of the one owned by the City of St. Louis, Dept. of Streets and Sewers. It has a capacity of 2700 pounds line pull at 175 feet per minute, and the compressor has a displacement of 90 cubic feet of free air per minute at 100 pounds pressure per square inch.

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any other provisions for them, and that entirely outside of anything directly connected with their employment or their duties. This insurance has no relation to the public health, public morals, nor the public safety, nor any of the other objects which come within the scope of the city's power. Attention is called to the granting of pensions to city employees, but it will be noted that in such cases the action of the city authorities is provided for by legislative enactment."

In the case of Eastern Illinois State Normal School vs. City of Charleston, 111 Northeastern Reporter, 573, it was held that defendant city was not impliedly empowered to contract to furnish water to plaintiff at nominal cost for fifty years, as an inducement for location of the school in the city. Such power did not result as an incident of its statutory authority to provide protection of the inhabitants of the city against fire, etc., nor from its power to furnish water for commercial consumption. The Court, in refusing to hold that the city was estopped to deny the validity of the contract, after having received the benefits of it, said:

"Every one is presumed to know the extent of the powers of a municipal corporation, and it cannot be estopped to aver its incapacity, which would amount to conferring power to do unauthorized acts simply because it has done them and received the consideration stipulated for."

In the case of Penley vs. City of Auburn, 85 Maine Reports, 657, the Maine Supreme Judicial Court held that persons who conveyed land to defendant city in consideration of the city's contract to keep a street open for its whole width were entitled to a reconveyance on the ground that the conveyance was without consideration, the city merely promising to do that which it was already legally bound to do.

Items of Municipal Law

By Statute, Claims of Municipality Against Insolvent Banks May Be Given Priority

An Iowa statute provides that in insolvency proceedings against a person, partnership or corporation, priority shall be given in favor of claims "of the state, county or municipal corporation." Applying the provision in the recent case of Bank of J. Kelso, 200 Northwestern Reporter, 492, the Iowa Supreme Court decided that a town was entitled to priority in distribution of a bank's assets on account of a deposit of town funds made by the town treasurer.

Validity of Ordinance Prohibiting Screens in Refreshment Places

In a recent case, the New Jersey Supreme Court has sustained the validity of a municipal ordinance forbidding maintenance in restaurants and soft-drink places of screens, blinds, etc., obstructing view of the interior from outside. The decision sustains the measure as reasonably tending to enable detection of violations of the prohibition laws.

The validity of such regulations, as applied to unlawful liquor sales at prohibited times, was well-established before Federal prohibition was enacted. (33 Corpus Juris, 515, 574.)

Limitation on Power of Cities to Expend Funds to Secure Legislation

The city of Juneau, Alaska, had no authority to expend money for the expenses of its acting city attorney in visiting Washington to forward the passage of legislation looking toward a division of the territory of Alaska, erection of a government building, dredging projects, etc., and not even to forward legislation authorizing issue of bonds for city improvements, held the United States Circuit Court of Appeals, Ninth Circuit, in the recent case of Valentine vs. Robertson, 300 Federal Reporter, 521. It was decided that charter authority to provide for the construction, etc., of streets, did not directly or indirectly confer power to expend money to secure congressional authority for issuing bonds for street improvements.

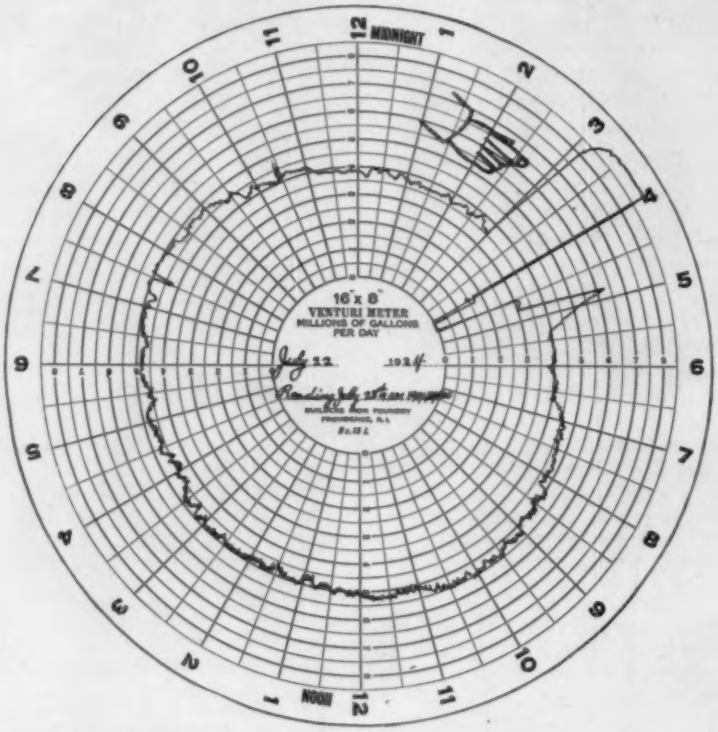
In the case of Farrel vs. Derby, 20 Atlantic Reporter, 234, the Connecticut Supreme Court of Errors upheld the right of a city to employ counsel to *resist*, before the Legislature, a proposal to divide its territory. And in a New York case (In re Taxpayers & Freeholders, 50 New York Supplement, 356), it was held that, under statutory authority to employ an attorney "when the business of the board of trustees of the village requires," the trustees might employ an attorney to appear before the Legislatures in respect to law pertaining to the town.

On the other hand, in the case of Henderson vs. City of Covington, 14 Bush's Reports, 312, the Kentucky Court of Appeals ruled that a city council had no power to expend funds to secure extended powers by legislation.

In the case of Field vs. City of Shawnee, 54 Pacific Reporter, 318, the Oklahoma Supreme Court held that defendant could not employ plaintiff to attempt to induce the Secretary of the Interior to require a railroad company's line to be located within the territorial limits of the town.

And the California Supreme Court declared to be unauthorized employment of an attorney to lobby against a certain bill pending before the Legislature (Colusa County vs. Welch, 55 Pacific Reporter, 243). In Coolidge vs. Brookline, 114 Massachusetts Reports, 592, it was held that a town could not defray expenses incurred in opposing a bill to annex a whole or part of its territory to another town. A similar conclusion was reached in the case of Westbrook vs. Deering, 63 Maine Reports, 231, and the United States Circuit Court of Appeals cites other decisions to the same general effect.

The Tattle Tale



AT EXACTLY three o'clock in the morning of the 22nd a hydrant suddenly blew off from the main pipe line in Newport, Ky.

For one hour the water tore up the street at high velocity before the district could be finally shut off.

At 4:30 the water was turned on again and the city's line refilled.

At 5:30 the 16-in. Venturi Meter on the main supply line between Covington and Newport showed normal flow restored.

The Venturi Chart Record immediately tattled the entire tale to the superintendents of both water departments.

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Zoning Notes

Prepared by Frank B. Williams
Author of "The Law of City Planning and Zoning"
From data collected by the Zoning Committee of New York (233 Broadway)
Mr. Williams may be addressed in care of THE AMERICAN CITY, 443 Fourth Avenue, New York

Recent Zoning Ordinances

BELMONT, MASS.—Ordinance January 19, 1925.
WOBURN, MASS.—Ordinance, January 2, 1925.
WORCESTER, MASS.—Ordinance, January, 1925.
MAMARONECK, N. Y.—Ordinance, February, 1925.

Recent Zoning Decisions

The Baltimore Decision

Unquestionably the important event of the month is the decision of the Court of Appeals of Maryland with regard to the recently adopted zoning ordinance of Baltimore. It is true that the majority opinion in Goldman v. Crowther, Inspector of Buildings for Baltimore City, is what is called a dictum. All that the case actually decides is that the record of proceedings below is unsatisfactory in that it does not show affirmatively that the petitioner has complied witn the prerequisites to the issuance of the permit he asks for, allowing him to conduct a business in a residential district; so that the case must be heard anew below. In effect, however, it is in all probability decisive, unless perhaps the case is presented a second time in a manner quite different from that in which it was at first tried.

The plaintiff applied for a permit to conduct a tailoring establishment in the basement of a four-story dwelling in a residential district. In rendering an opinion to the effect that, if made in due form, such an application should be granted, the majority of the Court said that the provisions of the ordinance were a deprivation of property without compensation contrary to the Constitution because they did not bear any substantial relation to the public health, security, morals, welfare or comfort and were not therefore valid police regulations. The judges also raise the question whether the police power can validly be exercised "for any such elastic and indeterminate object as the general prosperity without compensation." There are decisions, among them these of the Supreme Court of the United States, that, in any event it may be used for certain phases of public welfare.

The opinion passes upon the use provisions of the ordinance, but not upon the clauses regulating height and area, which it seems to regard with more favor.

The Court, although holding that the Board of Appeals was properly created, says that the provision giving it power to vary the strict letter of the ordinance in accordance with its spirit that substantial justice may be done is invalid because it does not lay down a sufficiently definite rule for the Board to follow.

The able dissenting opinion, concurred in by Judge Urner, is written by Bond, Chief Justice of the Court, and discusses the various questions thoroughly and at length.

The hopeful feature is that the Court dwells upon the fact that the ordinance, as presented at the trial and hearing of the case, does not to the Court appear in fact to be based upon considerations of public welfare, security, health or morals. This would seem to leave it open to the city in the second trial to show exhaustively and in detail, if it sees fit, that the ordinance is founded upon these considerations.

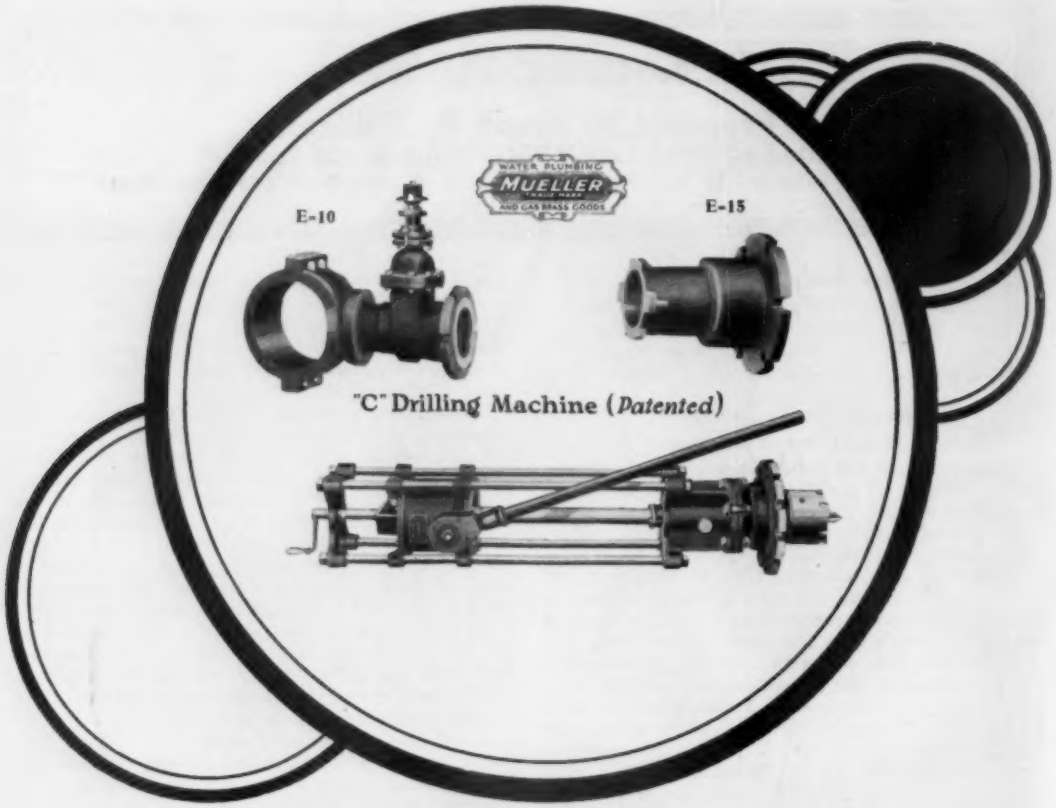
ALABAMA.—*Standard Oil Co. v. City Commissioners of Montgomery, Circuit Court.* The plaintiff obtained a permit for the erection of a filling station in June, 1922. In September, 1922, the city passed an ordinance forbidding the erection of gas filling stations and other named structures within 200 feet of any hospital, church or school or in a block two-thirds residential without the consent of a majority of the property owners. In June, 1924, the city passed a comprehensive ordinance. Under both ordinances the erection of a filling station on the lot in question was forbidden. The company had done no substantial work on the building. *Held,* that the ordinances were valid and the completion of the station could be enjoined.

KANSAS.—*Leland v. Turner,* 117 *Kansas* 294. An injunction will be granted against an undertaking establishment in a residential neighborhood on account of the mental depression and distress caused by the business to those in the neighborhood, lowering the powers of resistance to disease and depriving them of the comfort, repose and enjoyment to which they are entitled. The Missouri case of Tureman v. Kettlin, 263 S. W. 202 (digested in the July, 1924, "Notes") was followed.

NEW YORK.—*People v. Linabury, President of Gramatan Coal & Supply Co., County Court, Westchester County,* February, 1925. The taking of sand from land in a residential district created by a zoning ordinance of the city of Yonkers is not contrary to the provisions of the ordinance. *City of New York v. Holzman* (digested in the September, 1924, "Notes") and *Bartsch v. Ragonetti* (digested in the January, 1925, "Notes") were followed.

People ex rel. Drazan v. Moore, Supreme Court, Kings County, reported in *New York Law Journal,* January 13, 1925, p. 1405. Section 20 of the New York City Zoning Resolution prohibits the erection of a garage for more than five cars "within a distance of 200 feet from the nearest exit from or entrance to a public school." The applicant claimed that the line should be run following the line of the sidewalk and crossing both streets at right angles, in which case it would be more than 200 feet in length. *Held,* that the line should be straight, especially when, as here, it is in a public highway and does not touch any building.

People ex rel. Werbelowsky and Lavine Realty Corporation v. Walsh, Supreme Court, Kings County, reported in *New York Law Journal* for January 13, 1925, p. 1405. The Board of Appeals of New York City may permit a building formerly used as a theater in a residential district to



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Finely tempered shell drills make a clean, even cut. One shaft answers for cuts of all sizes and the automatic feed not only facilitates work but prevents over feeding.

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be changed into stores, and a private market, and an adjoining vacant plot to be built upon for the same use. *People ex rel. Facey v. Leo*, 110 *Misc.* 516, *affd.* 193 *App. Div.* 910; *affd.* 230 *N. Y.* 602, cited and followed.

Recent Zoning Literature

The Situation in St. Louis

The St. Louis *Post-Dispatch* for Friday evening, January 30, contains an illustrated article describing in detail what has happened in St. Louis since the zoning as it then existed was declared unconstitutional by the courts, sixteen months ago. The article entitled "How Zoning Law Knock-out Has Affected St. Louis," shows that 198 permits have been granted for buildings in locations where, under the ordinance, they would not have been permitted. The total cost of these buildings was considerably more than $4,360,075 as given in the permit applications—"so much money spent for structures in streets and neighborhoods where they do not belong, in the judgment of the city, based on scientific planning principles."

In its issue of January 31, the paper, in an editorial entitled "City Without Zones," says of the present situation:

> "Sixteen months have passed since the State Supreme Court declared the St. Louis zoning ordinance in conflict with the Constitution. The result to-day is to be seen in defaced and mutilated residence districts all over the city, as illustrated in yesterday's *Post-Dispatch*. Speculators and profiteers have gained in the debasement of residence values. Home owners have lost, and the entire city is the worse for it. The removal of protection from home investment must have affected home values unfavorably. . . .
>
> "Even the effect of the defunct zone law has been exploited to swell the gains of builders for profit, for the districts formerly reserved under the zone plan are said to yield better revenues as apartment sites than if they had never been restricted."

Of especial interest in this connection is the article by Harland Bartholemew, City Planning Consultant, of St. Louis, in the December number of *National Municipal Review*, entitled "Present Status of Zoning in Missouri," in which the situation, not only practically but legally, is stated and analyzed.

Zoning at the Meeting of the Engineers, Detroit, October, 1924

In the January "Notes" some reference was made to the papers read at the meeting of the City Planning Division of the American Society of Civil Engineers, October 24, 1924. These papers, now printed in the Proceedings of the Society, February, 1925, have been issued as reprints, and include the following:

Zoning and Health.—By George C. Whipple.
Zoning for Use.—By Edwin A. Fisher.
Area Zoning.—By Harland Bartholomew.
The Purpose of Zoning Ordinances and Methods of Administration.—By Morris Knowles.
Height Limitations in Zoning.—By Jacob L. Crane, Jr.
House Density Regulation.—By Robert Whitten.
Building Line Zoning.—By Lawrence V. Sheridan.
The Relation of Zoning to the Design of Drainage and Sewerage Systems.—By Paul Hansen.
The Influence of Zoning on the Design of the Street System.—By T. Glenn Phillips.
The Influence of Zoning on the Design of a Telephone Plant.—By Albert P. Allen.
The Influence of Zoning on the Design of Public Recreation Facilities.—By C. E. Brewer.
The Influence of Zoning on the Design of Transportation Services.—By J. Rowland Bibbins.
Zoning and Water Supply.—By H. Malcolm Pirnie.

These papers are a contribution of great importance. Especially significant and timely is the article entitled "Zoning and Health," by Professor Whipple, whose recent death was such a loss to zoning and public health in this country. Unquestionably, the popularity and rapid spread of zoning in this country has proved to be a menace to zoning; for it has in some cases, led to imperfect legislation, enabling municipalities to zone, inadequate preparation of zoning ordinances by municipalities, and unskillful presentation of zoning by lawyers before our courts. The result has been, in a few of our states, adverse judicial decisions. The Department of Commerce at Washington has given us a model enabling act which is being widely followed and is rapidly putting legislation on a sound basis. The proper preparation of zoning ordinances and their proper presentation to the courts is no less essential. If city planning practitioners and lawyers will read and apply the precepts of Mr. Whipple in this paper, they will find it of the greatest aid to them in their part of our common task.

City Placards 300 Apartment Houses as Being Unsafe in Case of Fire

STIRRED by the results of a recent fire, city officials in Boston have taken action against 300 apartment houses in various sections of the city the owners of which have not complied with orders for the installation of sprinklers.

As reported in the *Boston City Record*, hundreds of apartment houses, lodging-houses, hospitals and hotels had previously been compelled to safeguard their structures by both fire-escapes and sprinklers. Many cases, however, had been brought to the courts and lengthy litigation resulted.

In January a list was compiled by Assistant Corporation Counsel Leo Schwartz of houses where the sprinkler installation orders had been delayed or flatly ignored. Building Commissioner John H. Mahony decided that the time had come to take drastic action, and, accompanied by Fire Commissioner Theodore A. Glynn, Health Commissioner Francis X. Mahoney, Chief Edwin H. Oliver of the Building Department and Mr. Schwartz, he began a tour of the city.

At each place on the long list Commissioner Mahony tacked the formal notice which the Department uses but seldom. This reads as follows:

> **NOTICE**
>
> **Notice is hereby given that a violation of the Building Law, viz., chapter 550, Acts of 1907, exists on the building to which this notice is affixed, and is a common nuisance.**
>
> **JOHN H. MAHONY,**
> **Building Commissioner.**
>
> **This notice shall not be effaced nor removed without consent of the commissioner.**
>
> **Whoever violates any provision of this act shall be punished by a fine not exceeding $500.**

The apartment houses affected include from ten to forty apartments each.

The Dana Portable Pump for Fire Protection in Small Towns

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District Foresters of New York State approving the use of DANA Portable Pumps for Forest Fire Protection, Albany, N. Y., February 20, 1926

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Value of a Transportation Manager to a City

Some Reasons Why a Municipality Should Watch Transportation Costs

By Wayne E. Butterbaugh

Director of Education, Traffic Management Department, La Salle Extension University

MANY problems of cities, towns and villages are not unlike those met with by commercial and industrial enterprises. Just as the stockholders of a corporation insist upon the use of up-to-date methods and practices, so the taxpayers are demanding modern business management from city administrations. This calls not only for good auditing, financing, and purchasing, but also for the use of common sense plus skill in the management and movement of commodities. A few examples of how an industrial or commercial traffic manager can aid a municipality will illustrate the every-day need for technical traffic guidance.

Overcharge and Loss and Damage Claims

It is the common practice of municipalities to purchase coal and the supplies used by the various departments upon a delivered basis. The transportation charges being deducted from the invoice, the burden of collecting any overcharges that may occur thus falls upon the shipper.

In like manner, any loss sustained by the city because of damages to shipments occurring in transit is usually passed on to the shipper for adjustment. This method of purchasing supplies upon a delivered basis is the reason why most city administrations do not have adequate traffic protection. A few cities, especially those having a commission form of government or a city manager, arrange for an audit of freight bills on inbound shipments, and the adjustment of loss and damage claims against the carriers. In most of such cases the services of the local chamber of commerce traffic bureau, or of a firm of industrial traffic managers, are employed. At the average city hall there is no employee versed in the handling of claims. Some one might well be selected to study this work, and when he is competent, the function be delegated to him for handling.

Costs of Transportation, Cartage and Trucking

Where the cost of transportation is a large item in the delivered price of purchased supplies, such as coal, a careful survey should be made of the freight rates paid in comparison with the rates from other producers or manufacturers. This will indicate sources where the best values may be obtained from a transportation cost standpoint.

In most cities the cost of local cartage and the trucking of coal, ashes, and garbage offer great opportunities for traffic economies. A careful selection of the cartage companies whose services are employed cannot fail to result in economies, as it does to any industry moving a large volume of material over the highways. Traffic surveys dealing with the pick-up, transfer, and disposal of garbage in a number of cities have resulted in great savings by pointing out the advantageous use of trucks and trailers adapted to that type of service, and the proper routing and scheduling of the service.

Problems Require Analysis

There are various other ways in which a traffic man can make himself valuable to a municipality; for instance, by inspecting, weighing, and checking incoming shipments, and by auditing transportation bills. Any municipality can well afford to employ either a specially trained traffic man or a firm of traffic experts for the purpose of making an independent survey of their transportation problems. A report should be prepared recommending the introduction of such methods of handling shipments as will result in economies.

For the smaller cities and towns the day-to-day handling of these matters can be administered by an employer in the office either of the auditor or of the official handling purchases. An employee who has had traffic or railroad experience or who has studied transportation and traffic management should be engaged for this work, or trained to handle it on the job.

But for cities having a population of 50,000 or more, a capable traffic manager should be engaged. The larger the city, the greater the opportunity this executive will have in reducing costs and eliminating losses. This is a matter that should receive the serious attention of all municipal officials responsible for better administration.

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scientifically made by the Fairchild System, bring the complete detail of existing physical conditions to the desks of the engineer and the planning commission. The preliminary study can be made without time-consuming trips here and there in the area. A small scale will serve. For detail study, large scale maps of specified sections can be had at nominal cost.

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made from the same photographs will cut the cost in half when sewers, watermains, etc., are to be planned for outlying areas. Topography secured in this manner in connection with the photographic map affords the most informative and effective method for road and street layout or plan. The Fairchild method will save two-thirds of the time in making contour maps.

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Items translated from "Tablettes Documentaires Municipales" by Stephen Child, 538 Merchants Exchange Building, San Francisco, Calif., to whom requests for further information regarding this source of civic documentation should be addressed

City Planning—Moscow, Russia. 71.31 (47.31)

A city planning scheme for the city of Moscow and its environs has recently been prepared by a group of eminent architects, their report in six volumes having recently been issued. The dominant purpose of the authors of the plan has been to preserve the general aspect of the city while at the same time directing its growth in accordance with the most modern city planning principles. Up to the present time Moscow has been developed concentrically. The commercial portion, called The Golden City (La Cite d'Or), goes back to the early history of the community; the "White City" extends all about this, and when this "White City" became too crowded, another outer belt, "la Ville de Terre," grew gradually outward.

The present plan includes several circumferential avenues beyond which belts of verdure will extend, these broadening to include garden villages, existing and proposed. A network of radial avenues is also provided. The authors have attached great importance to the open verdurous spaces, which are planned in a broad circle or belt connected to the city by radial avenues. This broad circular zone which protects the city is from a mile to a mile and a half in width, and the total area of such reserved open spaces is about one-third of the area of the "Greater Moscow." This combination of circular belts of open verdurous land and the more or less wedge-shaped areas connecting them will permit pure air to penetrate the very heart of the city. The proposed plan has not met with unanimous approval, some believing that it tends too much to create one huge city and does not sufficiently provide for decentralization and the formation of satellite towns.

The Extension of Dordrecht, Holland. 71.31 (492.61)

Dordrecht, like Amsterdam, was originally developed concentrically, with each extension of the city a new canal having been excavated around the older portion. Later came an epoch which closed only with the beginning of this century, during which the city's growth became entirely disorganized. In 1914 a general plan for the extension of the city was prepared, a plan which merges itself into the older concentric scheme in the sense that it foresees extending about the city, not a new canal, but a belt of verdure. At present the city has grown more toward the south and east. The greater part of the land utilized for building is the property of the city. Several new housing groups are proposed. All the buildings erected by the city and by the housing societies are the work of a group of architects, and they have cooperated to realize an harmonious ensemble. Buildings erected by individuals, which are as a rule the work of less competent designers, contrast unfavorably with the others mentioned.

The First Garden City at Zurich, Switzerland. 71.313 (494.34)

A cooperative society, "Familienheim Zurich," founded in 1924, has sponsored the building of a garden city to help its members, most of whom have several children, secure better, more ample and more healthy homes at low rentals. They expect to build 200 single-family houses, in two types—one with four rooms and one with five, in groups of two and four houses each. Each house will have from 1,800 to 2,700 square feet of garden space or yard, assuring, they believe, the garden city idea. At the entrance to the city they are building a community-center house that will include a library and lecture halls, also a schoolhouse and two large blocks of stores. The project is to be completed in the summer of 1926.

Port Improvements at Rochelle-Pallice, France. 71.5:62.72 (44)

Rochelle-Pallice is an important fishing port, and in order to provide better facilities the municipality is lengthening the tidal basin, building a drawbridge and extending the breakwater. The new mole will be some 3,000 feet long, connected to the mainland by a viaduct 3,500 feet long, and will have a passenger station and a freight station. Besides all this, a new fishing port is projected at Vaugouin capable of handling 150 steam trawlers. There will be two jettees about 80 acres in extent with a channel 86 yards wide and a basin 600 feet in length with an area of 35 acres; all this relieving the congestion at La Rochelle.

The Public Gardens of Vienna, Austria. 71.6 (43.6)

The first public gardens of Vienna date from the first extension of the city following the demolition of its earlier fortifications. This resulted in the City Park and a park for children, as well as the City Hall Park. The second extension of the city in 1899 led to the creation of the famous Ring-Strasse Boulevard of Vienna, some four miles in length, with garden and pleasure grounds. At about this time the city acquired the Arenberg and Wertheimstein Parks and another located on the emplacement of a very old Turkish fortress and known as "Turkenschanzpark." As a result of the Great War there has been a cessation of the development of the park system, but this is now to be continued. Plans are being prepared for the development of Waldmuller Park, South Gardens, Schwarzbergplatz, Praterstern, Sachsenplatz, and several others. A municipal or public garden is to be reserved for the cultivation of ornamental plants.

Colombo, Ceylon, India. 72.5 (54.87)

The city of Colombo, Ceylon, is building without the intervention of a contractor a new city hall in the modern classic style of architecture which will cost about $450,000 and is expected to serve the needs of the city for 50 years.

Land Policy of Helder, Holland. 33.3

When, in 1920, Helder instituted a land exploitation policy, it acquired not only certain areas of land situated close by the city, but others some distance away which might not be needed for building purposes for some years. It was hoped in this manner to assure to the city the benefit of future rise in value. These lands were disposed of through a method of heritable leasehold. But to-day the city has been convinced that too much of its capital has been invested in land and that these lands rented on long-term heritable leasehold should bring in greater returns. The municipality has therefore reconsidered their earlier determination to adopt as a general rule this heritable leasehold method, and a part of this land will be sold.

Housing at Zurich, Switzerland. 33.332

Zurich has recently adopted a new policy of housing and of municipal statistics. From economic motives, the building of houses has been limited, up to the present time, to erecting buildings which could be most easily sold; hence the needs of the great masses of poorer people were taken into consideration only in slight degree. There is now recognized the necessity of a public housing policy which will emphasize the needs of the poor classes. To this end it becomes necessary to inquire in the first place as to their particular needs and then to completely meet these. Here housing statistics are inadequate and a reform is absolutely necessary in order to establish the needs of different classes; taking account of family conditions, the number of adults and of children of both sexes. The object of the statistics should be to visualize, not the isolated individual, but rather the household group. The proposed scheme of statistics is to be very valuable, for on the basis of these facts will be worked out not only the municipal but the national housing policy which will be adapted to the present needs of the entire population.

Arterial Roads in the County of Middlesex, London. 71.5 (42.1)

Middlesex County, an important district of greater London, is planning the construction of several main or arterial roads to cost some £2,230,000. Among the projects is the so-called "Watford by-pass," which is to be laid out 100 feet in width, with a central pavement of about 30 feet in width bordered by two bands of grass and planting, each some 20 feet in width and two sidewalks 10 feet wide, while along the fence line a planting space of about 5 feet is to be reserved. Another by-pass road is proposed at Barnet, to be nearly 8 miles in length, and various other projects are being considered.

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Boston Year Book, 1923-1924.—A cloth-bound volume of 538 pp., published by the Statistics Department of Boston, the first of the series. It shows the growth and development of the city and the community, and describes the functions of the various departments, boards, bureaus, and committees which administer the city affairs, emphasizing also metropolitan conditions and progress. Photographs, charts, tables. A most creditable and interesting piece of work. Later issues will include concise reports on what each department has accomplished during the year, thus doing away with a large number of burdensome and expensive reports of departments. $2.50. (Apply to William T. Seeger, Secretary, Statistics Department, 73 City Hall, Boston, Mass.

Sundry Proposals and Plans for the Development of Local Transportation Facilities in the City of Chicago.—Including the following reports: Program of Proposed Extensions of Elevated Railroad Lines to Provide Improved Rapid Transit Facilities in the City of Chicago, by the Chicago Rapid Transit Company; Outline of a Plan for a Comprehensive United System of Local Transportation, by Henry A. Blair; Proposal of Chicago City Railway Company, Calumet and South Chicago Railway Company and Southern Street Railway Company for Exchange of Transfers Between Their Lines and City-owned Rapid Transit Lines, Construction of Extensions of Their Lines, and Negotiations for the Purchase of Their Properties by the Use of Schwartz Certificates, together with a Discussion of Chicago's Local Transportation Problem, by Leonard A. Busby; Suggestion of a Franchise Grant to the Chicago Motor Coach Company for the Operation of Motor Buses in the City of Chicago, by James G. Condon; and Plan for an Independent Municipal System of Rapid Transit Lines in the City of Chicago, Including Elevated Railroads and Subways, by R. F. Kelker, Jr. 99 quarto pp. Maps, tables. $1.05. (Apply to Municipal Reference Library, 1005 City Hall, Chicago, Ill.)

A Study of Real Estate Assessment in Philadelphia, with Certain Recommendations for Improvements.—A report prepared for the City Club of Philadelphia by the Committee on Real Estate Assessment, Karl Scholz, Chairman. Published by the City Club of Philadelphia, 313 South Broad Street, Philadelphia, Pa. Supplement to the December 13, 1924, issue of City Club News. Covering the legal provisions regarding real estate assessments in Philadelphia and the actual methods and procedure of the work; analyzing the methods employed in estimating values of real estate in Philadelphia; showing the methods in several other cities; and presenting the principles of a scientific system of real estate and their application to Philadelphia. 63 pp. Charts, tables. (Apply to the City Club of Philadelphia.)

City Planning in Toledo.—Reports of the City Plan Commission, as follows: Major Street Report, 72 pp.; Port Study, 71 pp.; Railroad Transportation, 47 pp.; Transit Plan, 47 pp.; Industrial Survey, 24 pp. All quarto size, with maps, views, charts, tables. Presenting the existing conditions and the immediate and future needs of the city's development. Comprehensive, detailed, thorough studies. (Apply to Harland Bartholomew, City Plan Engineer, Compton Building, St. Louis, Mo.)

Public Health Administration and the Natural History of Disease in Baltimore, Md., 1797-1920.—By William Travis Howard, Jr., M. D. Published by the Carnegie Institution of Washington, Washington, D. C. VI + 565 pp. Tables, graphs, folding maps of the city in 1801 and 1851. A very careful study of the origin and evolution of public health laws and practices in Baltimore, and of the natural history of recorded diseases in the city, with all the influences affecting them. The purpose of the study is to secure more effective disease control. (Apply to the publishers.)

An Inexpensive Hard-Surface Play Court.—By A. D. Browne (M.D.), George Peabody College for Teachers. Reprinted from the Peabody Journal of Education, September, 1924. 4 pp. Recommending and describing the construction, in the school yard, of hard-surfaced play courts, "at a cost within the means of almost every school in the South." "Play courts such as these, with the equipment described, have been made on the campus of the George Peabody College for Teachers, in Nashville, Tenn., and are giving splendid service." (Apply to the College.)

Laboratory Investigation of a New Theory of Sheet Asphalt Paving Mixtures.—By Moray Fraser MacNaughton, Roy D. Chapin, Fellow in Highway Engineering, University of Michigan, and Construction Engineer, Milton Hersey Company, Ltd., Consulting Engineers and Chemists, Montreal, Que. Reprinted from the Proceedings of the Tenth Annual Michigan Conference on Highway Engineering, held at the University of Michigan, Ann Arbor, Mich., February 11-14, 1924. 66 pp. Drawings, charts, tables. A review of the history of sheet asphalt paving, as to design and mixture, and an investigation of proposed methods of determining accurately the volume of bitumen-filled voids in the compressed aggregate in order to ascertain the stability of mixtures. (Apply to Milton Hersey Company, Ltd., Montreal, Que.)

Legislation for Parks and Recreation Spaces.—By Edward M. Bassett, Director, Legal Division, Regional Plan of New York and Its Environs. 8 pp. in the January, 1925, issue of The Playground, 315 Fourth Avenue, New York, N. Y. Part of this paper was presented at the Recreation Congress, Atlantic City, October 18, 1924. Discussing the problem of obtaining land for play-parks before the neighborhood is built up. (Apply to The Playground.)

How to Know and Use the Trees.—By William Chambers Coker and Enid Matherly. University of North Carolina Extension Bulletin, June 1, 1924. 72 pp. besides 39 plates. Emphasizing the trees of North Carolina, particularly their use for shade and ornament; including also some of the most useful exotic trees, and plans for planting grounds and streets, instructions for pruning and caring for trees, and other material of interest to schools, churches and towns. It gives a key to all the native species of trees in the state. $1.00. (Apply to University Extension Div., Chapel Hill, N. C.)

Everybody's Problem.—A special issue of "Chicago's Health," published weekly by the Chicago School of Sanitary Instruction, City Hall, Chicago, Ill. This number is a warning by Herman N. Bundesen, M. D., Commissioner of Health, Chicago, against the evil of ignorance regarding venereal disease, and of urging all those in charge of children to safeguard the health and happiness of the future. 32 pp. (Apply to the publishers.)

Tournament of Roses, Pasadena, Calif., 1925.—The New Year's Number of the Pasadena Evening Post. 68 quarto pp. A profusely illustrated account of the New Year's Day magnificent floral pageant in Pasadena. (Apply to the Evening Post.)

A Monograph on City or Village Planning and Zoning.—By George H. Herrold, Chairman, City Planning Committee, League of Minnesota Municipalities. Publication No. 6 of the League. January, 1925. 20 pp. Illustrated. An explanation in understandable manner of the principles and advantages of city and town planning and zoning, with brief statements from zoned communities as to the results of their zoning ordinances. This pamphlet is designed to make clear to Minnesota municipalities the proposed state legislation on this subject, and it includes the two proposed enabling acts, one on zoning, the other on city or village planning. (Apply to the League, University of Minnesota Library, Minneapolis, Minn.)

Commercial Survey of the Milwaukee Harbor.—A report (December, 1924) of the Milwaukee Board of Harbor Commissioners on the lake commerce of the city, past and present, and the probable trend of business in the future. Showing the wisdom of an outer harbor, and pointing out the change in the character of the city's commerce, and the necessity of meeting this change. 48 pp. Charts, maps, tables. (Apply to William George Bruce, President, Milwaukee Board of Harbor Commissioners.)

Report of the Americanization Bureau of the Delaware Americanization Committee, 1923-1924.—Published January, 1925, by the Service Citizens of Delaware. 100 pp. Photographs, tables. The work of the Americanization Bureau has been the operation of a center, known as the "Trouble Bureau," to which any foreign-born person may come for advice and assistance; the tabulation of a census of the foreign-born citizens of Wilmington, taken in the fall of 1923; and the collecting and classifying of informative material useful in solving the problems of the immigrant. (Apply to Grace D. Brewer, Director, Service Citizens' Americanization Bureau, 835 Market Street, Wilmington, Del.)

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The Augusta Survey.—Report of a community improvement study of Augusta and Richmond County, Georgia, conducted under the auspices of Augusta civic organizations, assisted by the Georgia Council of Social Agencies, and financed by the J. B. White Foundation. The survey was directed by Carter Taylor, and was participated in by more than 300 local people and 40 trained workers. It is said to be the first comprehensive community study ever undertaken in which the actual work was done by local people under direction of trained experts. VIII + 274 pp. Views, diagrams, tables. Covering the subjects of coordination, family welfare, child welfare, education, recreation, housing, industry, agriculture, religious life, jails, and health, as studied by committees in relation to Augusta. (Apply to the Augusta, Kiwanis Club.)

Selling the Kessler Plants to Dallas.—The January, 1925, issue of "The Kessler Plan for Greater Dallas," published by The Kessler Plan Association, 8 quarto pp. Illustrated with views showing the advantages of street widening and straightening. The Association is engaged in selling the plans already prepared, which it considers of paramount importance to the future of Dallas. (Apply to the Association, 1105 Mercantile Bank Building, Dallas, Tex.)

Laws of New Jersey Relating to Shade Trees.—A 12-page pamphlet published by the Division of Forests and Parks, Department of Conservation and Development, Room 100, State Office Building, Trenton, N. J. Including the laws regarding municipal and county shade tree commissions, trees on public roads, Arbor Day, and tree injury and destruction. (Apply to C. P. Wilder, State Forester, Trenton, N. J.)

Jury Service for Women.—By Jennie Loitman Barron. Publisher by the Committee on the Legal Status of Women, National League of Women Voters, 532 Seventeenth Street, N. W., Washington, D. C. December, 1924. 16 pp. An attempt to show the advisability of admitting women to jury service, and to answer some of the objections that are commonly given. The opinions expressed are not only based on the writer's experience as a practicing lawyer, but are also the views of judges, lawyers, court officials, publicists, social workers and others best qualified to pass upon the question. (Apply to the publishers.)

The Municipal Court of Chicago.—Two pamphlets. Decisions of the Supreme and Appellate Courts Affecting the Municipal Court and the Practice Therein: 69 pp.; published by the Municipal Court of Chicago. Rules of the Municipal Court of Chicago; 15 pp. Harry Olson is the Chief Justice of the Municipal Court of Chicago. (Apply for both pamphlets to the Municipal Reference Library, 1005 City Hall, Chicago, Ill.)

Pollution by Oil of the Coast Waters of the United States.—By E. W. Lane, C. P. Bowie, and J. S. Desmond. An investigation by the Bureau of Mines, Department of the Interior. Mimeographed, December, 1924. 14 quarto pp. (Apply to the Bureau, Washington, D. C.)

City Problems.—Proceedings of the Fifteenth Annual Meeting of the Conference of Mayors and Other City Officials of the State of New York, held in Rochester, N. Y., June 3-5, 1924. 145 pp. $1.00. (Apply to William P. Capes, Secretary of the Conference, Albany, N. Y.)

Municipal Reports Received

COOK COUNTY, ILL.—Annual Messages of President, Board of Commissioners of the County, and Forest Preserve District, 1924

HARTFORD, CONN.—Annual Report, Department of Engineering, year ending March 31, 1924

PASADENA, CALIF.—Annual Report, Water Department, 1923-1924

PHILADELPHIA, PA.—Annual Report, Registration Commission, 1924

PHILADELPHIA, PA.—Annual Report, Department of Wharves, Docks and Ferries, 1923

SAINT JOHN, N. B.—Annual Report and Accounts of the Corporation, 1923

WILMINGTON, DEL.—Annual Report, Board of Water Commissioners, 1923-1924

On the Calendar of Conventions

APRIL 13.—NEW YORK, N. Y.
National Committee on Prisons and Prison Labor. Annual meeting. Secretary, Miss Julia K. Jaffray, Room 1210, 2 Rector Street. New York, N. Y.

APRIL 20-25.—NEW YORK, N. Y.
National Conference on City Planning. International Town, City and Regional Planning Conference. Secretary. Flavel Shurtleff, 130 East 22nd Street, New York.

APRIL 22-24.—CINCINNATI, OHIO
American Society of Civil Engineers. Annual convention. Secretary, George T. Seabury, 33 West 39th Street, New York, N. Y.

APRIL 24-25.—ST. LOUIS, MO.
Missouri Commercial Secretaries' Association. Annual meeting. Secretary, Lawrence Jones, Chamber of Commerce, Independence, Mo.

APRIL 25-27.—LOUISVILLE, KY.
Conference of State Sanitary Engineers. Annual meeting. Corresponding Secretary, Arthur P. Miller, Assistant Sanitary Engineer, U. S. Public Health Service, Washington, D. C.

APRIL 27-MAY 2.—LOUISVILLE, KY.
American Water Works Association. Annual convention. Secretary. W. M. Niesley, 170 Broadway, New York, N. Y.

APRIL 28.—WASHINGTON, D. C.
American Civic Association. Pan American Conference on Capital Cities. Secretary, Miss Harlean James, Union Trust Building, Washington, D. C.

APRIL 30-MAY 2.—UNIVERSITY, VA.
National University Extension Association. Annual conference. Secretary, James A. Moyer, Massachusetts Department of Education, State House, Boston. Mass.

MAY 12-14.—CHICAGO, ILL.
National Fire Protection Association. Annual convention. Secretary, Franklin H. Wentworth, 40 Central Street, Boston, Mass.

MAY 12-16.—NEW YORK, N. Y.
International Police Conference. Annual convention. Secretary, Colonel R. Waldo, 240 Centre Street, New York, N. Y.

MAY 13-15.—CLEVELAND, OHIO
American Federation of Arts. Annual meeting. Secretary, Miss Leila Mechlin, 1741 New York Avenue, Washington. D. C.

MAY 18-21.—MILWAUKEE, WIS.
American Society of Mechanical Engineers. Spring meeting. Secretary. Calvin W. Rice, 29 West 39th Street, New York, N. Y.

MAY 20-22.—WASHINGTON, D. C.
Chamber of Commerce of the United States of America. Annual meeting. Secretary, D. A. Skinner, Washington, D. C.

MAY 25-28.—MILWAUKEE. WIS.
National Association of Purchasing Agents. Annual convention. Secretary, W. L. Chandler, Woolworth Building. New York, N. Y.

MAY 25-28.—SKYLAND, VA.
National Conference on State Parks. Annual conference. Secretary, Beatrice M. Ward, 905 Union Trust Building, Washington, D. C.

JUNE 15-17.—BILOXI, MISS.
Southern Commercial Secretaries Association. Annual convention-school. Secretary, Burke Hopgood, Chamber of Commerce, Durham, N. C.

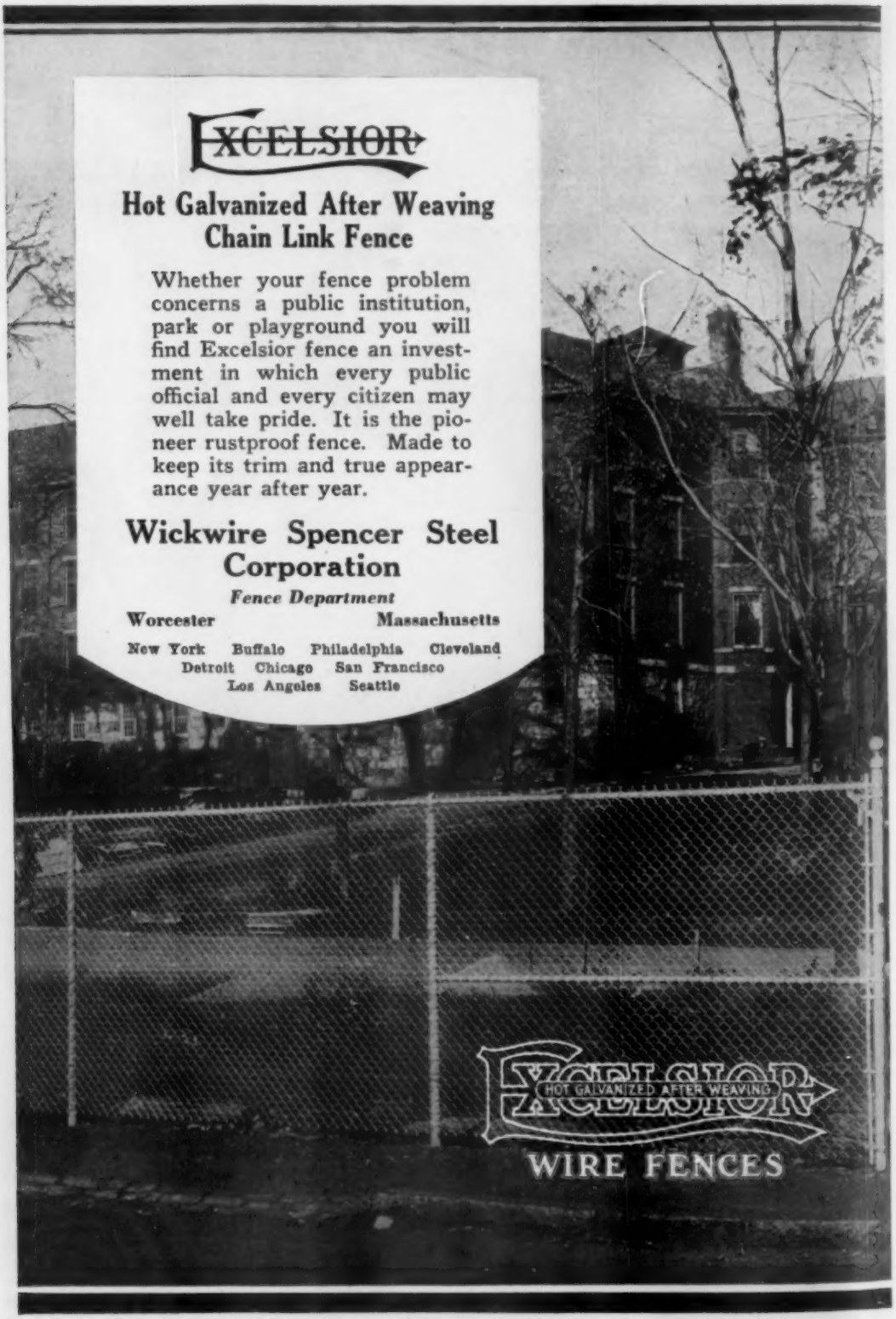
JUNE 15-20.—MINNEAPOLIS. MINN.
National Tuberculosis Association. Annual meeting. Managing Director, Dr. Linsley R. Williams, 370 Seventh Avenue, New York, N. Y.

JUNE 21-28.—BRUSSELS, BELGIUM
International Chamber of Commerce. Third general meeting. Address: Secretary, American Section. International Chamber of Commerce, Washington, D. C.

JUNE 22-26.—SARATOGA SPRINGS, N. Y.
American Institute of Electrical Engineers. Annual convention. Secretary, F. L. Hutchinson. 33 West 39th Street, New York, N. Y.

JUNE 22-26.—ATLANTIC CITY, N. J.
American Society for Testing Materials. Annual meeting. Secretary, C. L. Warwick, 1315 Spruce Street, Philadelphia, Pa.

JUNE 22-27.—LOS ANGELES, CALIF.
American Physical Education Association. Annual convention. Secretary, Dr. J. H. McCurdy, Box G. Highland Station, Springfield, Mass.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News and Illustrations

Items of Interest to City, Town and County Officials, and Others Interested in the Economical Construction and Efficient Operation of Public Improvement Undertakings

Diesel Engine Power for Pumping

THERE are two important factors in the choice of a power supply for municipal pumping which must be given careful consideration if the installation is to give satisfactory service. The first of these is dependability, and the second is the cost per million gallons pumped. The diesel oil engine has shown that it will handle pumping at a very low cost, as compared with either steam equipment or purchased power. The advocates of these two other methods of handling the power problem sometimes attempt to make a case around the dependability factor, stating that the diesel oil engine is not a reliable type of drive, that the maintenance costs are high, and that the depreciation is greater than for other types of equipment.

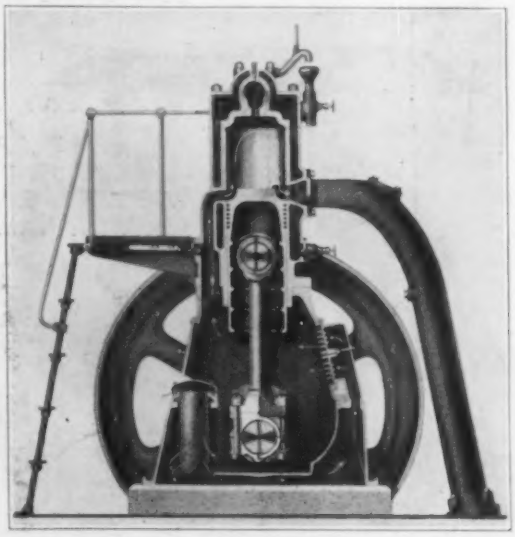
Without dependability low fuel and operating costs are not of much value, for the cost of a few service interruptions would tend to offset any gain in reduced operating costs. As a matter of fact, however, the diesel engine is an extremely dependable machine, the maintenance costs are low, and the life of the equipment is long. When the diesel engine was first developed, and during the early years of its use, some mechanical troubles were experienced, such as crank-shaft breakage, cracked cylinder heads, failures to start properly, and service interruptions due to improper combustion. These failures are, however, matters of history, for the improvements in diesel engine design and manufacture have been fully as great as they have been with the automobile engine, and it is as unfair to compare the present-day engines with early types as it would be to compare the modern automobiles with those of an early era.

One of the advances which have been made in diesel engine practice has been in the development of the two-cycle solid-injection type on account of the mechanical and operating simplicity of this design. The four-cycle engine has both inlet and exhaust valves, which require care in setting to produce the best efficiency and which must be frequently ground in order to keep the engine in good operating condition. Low grades of fuel oil, particularly those of a heavy, sticky consistency, or containing a considerable sulphur content, cause trouble with the valves due to carbon or to corrosion.

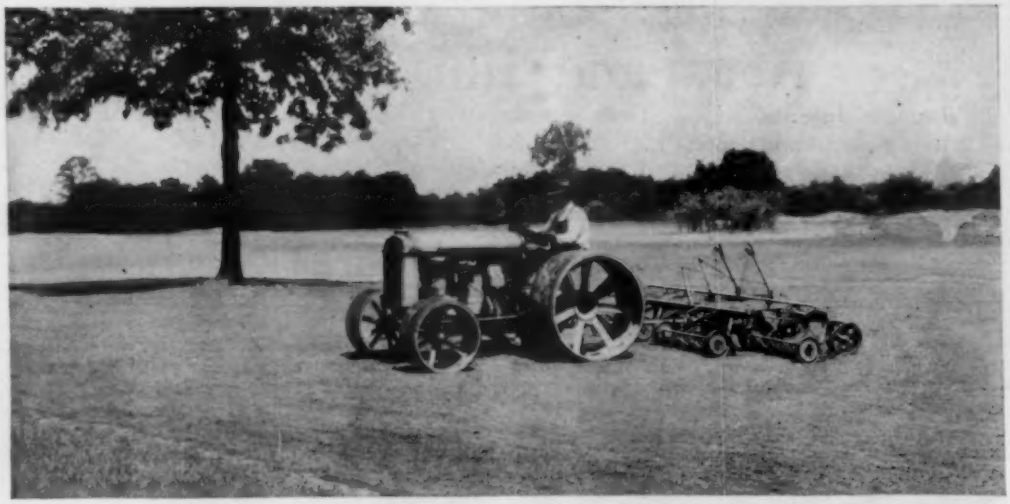
The early diesel engines also required the use of high-pressure air for atomizing the fuel, and this further complicated the construction. A multiple-stage air-compressor, which was necessary to furnish this high-pressure air, added another feature of equipment to be looked after, and the adjustment of the amount of air injected with the fuel required considerable care. The air-injection engine has, in both four-cycle and two-cycle types, of course, been improved in its mechanical design and is being used successfully, particularly in connection with large diesel engines. Both in this country and abroad, however, the trend has been distinctly towards the development of two-cycle solid-injection types and it appears that the engine of the future, even in the larger sizes, will be of this type.

In order to understand the reasons which lie back of the simplicity of the two-cycle solid-injection diesel engine, it is necessary to have some idea as to how this type operates. The new type "Y" diesel oil engine, which has recently been developed by Fairbanks, Morse & Co., is an example of a late design which will be used for illustration purposes.

Referring to the cross-section view of this engine, the first thing which will be noticed is the absence of complicated parts. In the two-cycle engine there are no inlet or exhaust valves, as the piston performs these functions. It will be noticed in the illustration that the piston is in the lower dead center position. On its way down to this position the air entrapped in the crank-case, which has come through the screen as indicated by the arrows, is slightly compressed, and when the air inlet port is uncovered by the piston, this air flows up through the passageway



SECTIONAL VIEW OF TWO-CYCLE SOLID-INJECTION TYPE DIESEL ENGINE



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and clears the cylinder of the gases due to the combustion.

On its return stroke, the piston covers both the air inlet and exhaust ports, and the charge of fresh air is compressed in the cylinder. As the piston approaches the top of the cylinder, the injection of the fuel oil takes place through the nozzle into the auxiliary combustion chamber. The air which is being compressed rushes through the neck of this chamber and meets the spray from the fuel nozzle and aids in breaking up the fuel into a finely atomized state. In the meantime, the piston has been moving up and the compression pressure has reached about 500 pounds per square inch, which raises the temperature of the charge to practically 1,000° F. Ignition then begins and the burning gases expand through the neck of the auxiliary combustion chamber into the cylinder proper, where combustion is completed.

It can be seen from this that no ignition devices are required, as the heat of compression fires the charge. There is no explosion in any sense of the word, for the fuel burns at a constant pressure. As the piston moves on its downward stroke, it first uncovers the edge of the exhaust port, and the burned gases pass out through this port and the pressure of the cylinder is lowered to practically that of the atmosphere. When the piston moves slightly farther, it uncovers the air-inlet port, and the air which has again been slightly compressed in the crank-case flows through the cylinder, thus clearing out the gases of combustion.

It will be noted from this brief description of the operation that the two-cycle engine receives a power stroke at every revolution of the crankshaft. In the four-cycle engine, there is a power stroke at every other revolution, since the piston on its upward travel must force out the exhaust gases through an exhaust valve which is timed to open at the proper moment. On the downstroke the piston on the four-cycle engine pulls in a fresh air-charge through the air-inlet valve, which is also timed to open at the beginning of the downward stroke. On the next revolution the charge of air is compressed and the fuel is injected, combustion occurs, and the piston again travels down on the expansion or power stroke.

In addition to the design of an engine cylinder, the arrangements for admitting scavenging air and for injection of the fuel, there are many other details which affect the dependability of a two-cycle solid-injection diesel engine. One important feature is in the arrangements which are provided for pumping the fuel to the injection nozzle, both as to the quantity of fuel pumped and the regulation of the time of such injection. In the engine just described, the fuel-injection and governor unit is mounted at the end of the engine. Each cylinder has a small fuel-injection pump, and the amount of fuel which is pumped to the cylinder is accurately controlled by the governor in accordance with the load on the engine. The engine is started by compressed air, and the control for this starting and the control for the fuel are also located on this fuel-injection and governor unit. In other words, the entire control of the engine is located at one point.

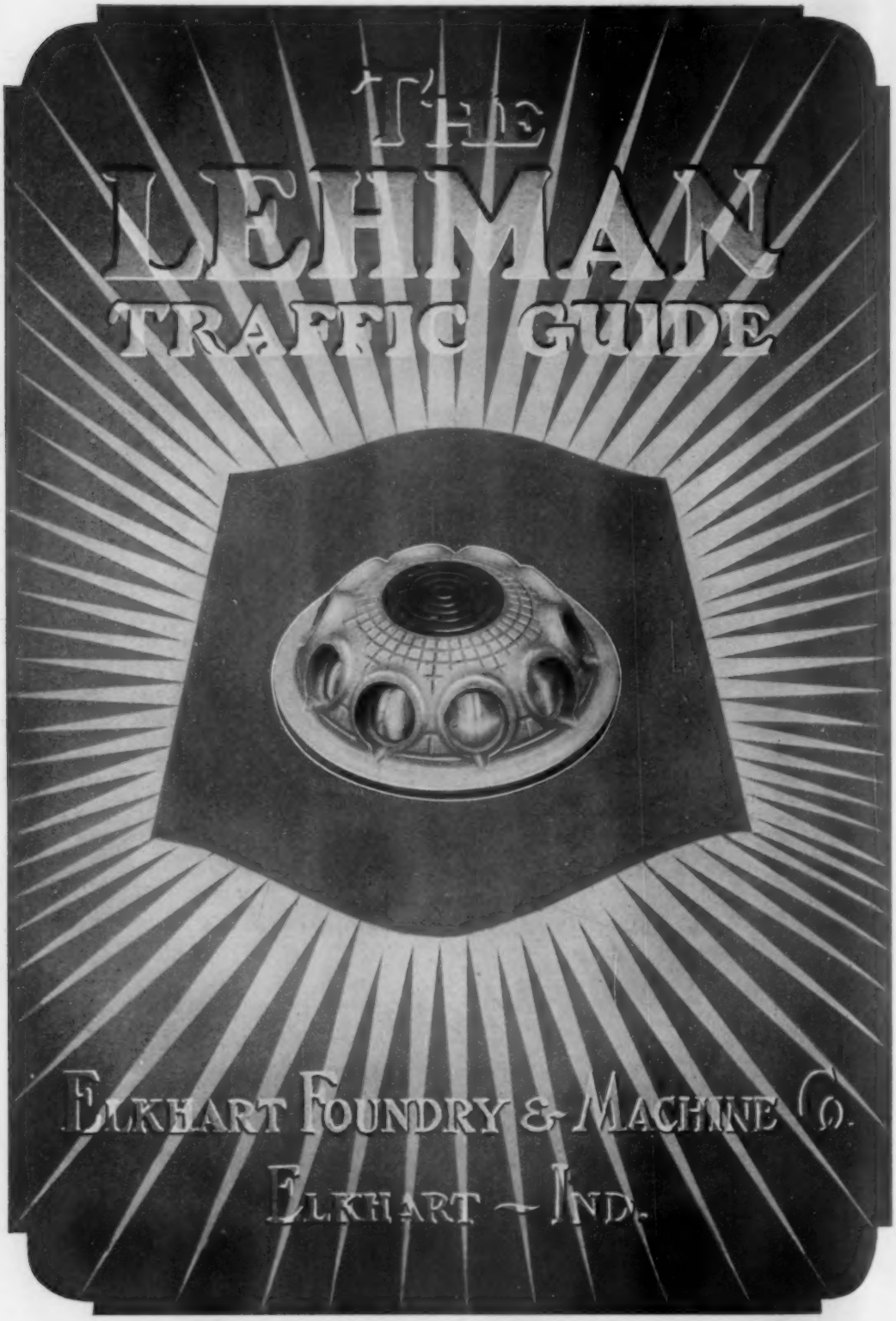
Another detail which has an important bearing on diesel engine dependability is in the arrangement which is provided for lubrication. In the early days, entire dependence was placed on the use of oil cups and oil holes, and the oil can was an important part of the operating equipment of the engineer. In the modern diesel engine, however, the operator is relieved of any such duties, as the lubrication is entirely automatic and is not dependent on the personal efficiency of the operating force. The mechanical lubricator, which is a rectangular box located at the end of the engine, is driven by the engine, and every bearing surface is lubricated with just the proper amount of oil. Aside from the fact that the engine is properly lubricated and dependability in operation is insured, the quantity of lubricating oil used is also reduced. In the early diesel engines the cost of lubricating oil sometimes almost equaled the cost of the fuel oil consumed. Automatic lubrication, with consequent reduction in waste, has meant that it is possible to guarantee 2,000 b.h.p. per gallon of lubricating oil, which is about one-fourth of that required by some of the early engines.

Because of the mechanical dependability of the diesel engine, repair expense is very low. With the possibility of crank-shaft breakage and cracked cylinder heads eliminated, there is not much else in the case of the two-cycle solid-injection engine which will go wrong. In fact, records of installations show a great many cases where the repair expense has been under $100 a year for periods of many years.

One of the points which always come up for consideration is the probable life of a diesel engine. This life has a direct relation to the dependability of the unit and it also depends upon a consideration of obsolescence. Mechanical equipment, such as steam engines and motors, does not wear out, but rather becomes obsolete because new types of equipment are brought out which are so much more efficient that it is no longer profitable to keep on using the original installations. The whole history of steam power-plant development is full of instances where steam turbines have been operated only three or four years and then have been replaced by more efficient machines.

The diesel engine, however, is so nearly perfect a machine from a thermal efficiency standpoint that the room for improvement is not very large. For that reason most of the improvements have been along mechanical lines, to insure greater dependability in operation.

In spite of the fact that great strides have been made in improving steam equipment, the fuel efficiency of the largest steam station in the country does not even come close to the fuel efficiency of a 50-h. p. diesel engine. On account of that fact, a diesel engine does not become obsolete and there is no need to replace it from that standpoint. Under reasonable operating conditions the engine should operate almost indefinitely and certainly an assumption of a life of 25 years is very reasonable. As a proof for that statement, it is interesting to note that most of the original diesel engines, which were built in this country around 1900, are still in operation, although they certainly will not compare mechanically with present-day units. The fact that these old units are still operating efficiently gives some indication as to what life may be expected and it also indicates that the cost of obsolescence is a factor which need not be considered. In that same interval practically all steam engines, steam turbines and electric motors have been replaced several times, but those old diesels continue to operate at a fuel consumption which is far under that of the most modern steam plant of to-day.



When writing to Advertisers please mention THE AMERICAN CITY—Thank you.

A Warning Sign That Lasts

A trip through the United States north of the Ohio and east of the Mississippi River explains readily why there are 15,000 lives lost in highway accidents and 1,700,000 injuries sustained in smash-ups at dangerous curves, bridges, culverts, railroad crossings, dead ends and the like in the United States each year. The vast majority of the fatal accidents have occurred at night and most of them could have been avoided had warning signals been in operation, according to information obtained from first-hand sources in an investigation conducted by R. A. Thompson, General Manager of the Automatic Sign and Signal Company, 1014 South Michigan Avenue, Chicago, Ill.

Any safety legislation designed to protect the motoring public should and will also include a provision prohibiting certain types of advertising signs along much-traveled roads. Such warning legends as "Stop for fine hot dogs at the next crossing" or "Turn right and use Oomplatz skid chains" confuse the motorist and render it likely that he will disregard a real warning signal or danger sign and perhaps imperil himself under the belief that there may be an ad hiding behind the sign.

Cook County, Ill., several years ago equipped its 250 miles of paved roads with a warning signal in the shape of a square red reflecting glass which appeared to be a bright burning ball of fire when the headlight glare of an approaching automobile struck it. After two years it has been found necessary to replace the red glass sign with an aluminum one to be known as the "Road Pilot," because the glass in the older signs remained unbroken such a short time.

A REFLECTING TRAFFIC SIGNAL

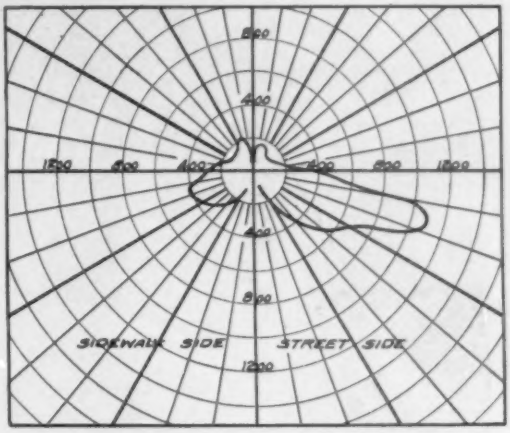
Roisterers passing in automobiles, hi-jackers and others traveling over the country roads during the last twelve months, appear to have amused themselves at almost every crossing by shooting the glass out of the automatic red reflectors put there to warn of an approaching curve or road intersection. These new aluminum signs, illustrated herewith, are of an alloy that will withstand even a bootlegger's bullet, covered with a translucent coloring matter on a bright aluminum reflector, and slightly larger than the old glass signs.

Brown Succeeds Sawyer for B-G

The Barber-Greene Company, Aurora, Ill., manufacturers of loading and conveying machinery, have announced the appointment of S. D. Brown, to succeed George L. Sawyer in charge of the New York office at 141 Centre Street. Mr. Sawyer, who has represented this company for the last five years in New York, has severed his connection with the company.

A New Residential Street-Lighting Unit

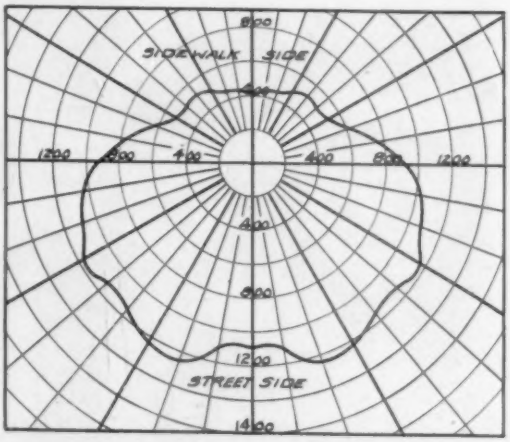
Economy in residential street lighting has been emphasized by the present conditions of street travel, as compared with those of a few years ago. Before the coming of the automobile and the motor truck, travel proceeded at about the same rate on both the roadway and the sidewalk—approximately 4 miles per hour. The illumination needs of the sidewalk and the pavement were there-



MAXIMUM LIGHT CONE AT 15 DEGREES BELOW HORIZONTAL WITH 6,000-LUMEN LAMP

fore approximately the same, but now, while pedestrian travel proceeds at the same rate as before, the speed of vehicular traffic has increased at least five-fold. Also, while the volume of sidewalk travel has been augmented only by the natural increase in population, the roadway is crowded, the increase there having been many times greater. Hence, while the sidewalk needs no greater measure of illumination now in general than it did in pre-motor-car days, the roadway requires a great deal more.

Two ways of supplying this additional illumination have been available—the installation of lamps of greater candle-power in symmetric distribution units, or resorting to the re-directional feature of



LIGHTING CURVE WITH 6,000-LUMEN LAMP ALONG VERTICAL PLANE AT RIGHT ANGLE TO THE SIDEWALK

MUSHROOM

Reg. U.S. Pat. Off.

Traffic Lights

ESSCO MFG. CO.

PEORIA, ILLINOIS

When writing to Advertisers please mention THE AMERICAN CITY—Thank you.

asymmetric distribution to gather up the otherwise wasted light and centralize it on the pavement.

The success of the asymmetric distribution method, however, depends upon its proper application. Unless the redirection is accomplished properly, the result is in the nature of two strong beams of light with resultant glare. In other words, the lighting units become something like a spotlight throwing two dazzling columns of light up and down the roadway, according to engineers of the General Electric Company, Schenectady, N. Y. The illumination on the surface of the pavement is brilliant but spotty, with a tendency toward a twilight zone directly opposite the unit, bright spots on the globe, and shadows beneath it. Where such conditions exist, it is probable that although the intensity of the illumination may have been more than doubled, one's ability to see may be actually diminished. In this connection, it may be well to remember that the distinctness of an object is determined not by the intensity of light on the object, but rather by the brightness of the retinal image. This brightness results from the amount of light that actually enters the eye, which will vary directly as the area of the diameter of the pupil. Glare quickly causes pupillary contraction.

Where it is possible to elevate the unit to a sufficient height, these objections can be overcome. For example, asymmetric distribution works out admirably in highway lighting where the units are mounted 35 feet above the road surface. It is often impossible to elevate them to such a height on a residential street, however, because of trees, or perhaps it may be undesirable for other reasons, among them the added cost of standards and the glare of light in the upper rooms of the houses.

The problem has been, therefore, to devise a method of refraction which would permit the use of asymmetric units mounted at feasible heights for residential thoroughfares, which would provide for the spreading of the light in such a way that there would be no glare and no dark spot across the street and so design it that the unit would not differ in outward appearance from symmetric distribution units used elsewhere in the city.

Working along this line, engineers of the General Electric Company, Schenectady, N. Y., and the Holophane Glass Company, New York City, jointly have devised a new refractor which has met the requirements named above, to be used in conjunction with Novalux lighting units. This refractor will be known as the A-Sym-Etric dome refractor. Its prisms are so arranged that while the downward distribution of light is not intercepted, the upward rays and most of those that start to pass in the direction of the houses are caught and directed toward the roadway in wide, shallow arcs. The light spreads fanwise. This wide diffusion eliminates glare, eliminates the twilight zone across the street, eliminates the spots on the globe and also the shadows beneath the unit. At the same time, a sufficient amount of light to illuminate the sidewalk, the lawns and the first-floor front of the houses is provided. The direction of the distribution is indicated by the accompanying diagram.

The A-Sym-Etric dome refractor may be placed in any of the rippled glass G-E Novalux globes, the light source being a Mazda C lamp of whatever candle-power is desired. Hence the same Novalux unit with these refractors or with symmetrical dome refractors or with no refractors may be used in the same city without interfering with the uniformity in outward appearance of the lighting equipment. The importance of this is obvious. No municipal electrical superintendent needs to be told of the diversity of lighting requirements that may characterize a single street. A thoroughfare may start as a main business street where symmetric distribution white way lighting is needed; continue as a secondary business street, where a certain amount of directional control of the light is desirable; and end as a residential thoroughfare where the right kind of asymmetrical distribution is the need. Similarly, the preferences of individual residents can be met, if necessary. Some residents object to light above the first floor, from street lamps. Globes painted on the house side to obstruct the light are frequent reminders of this dislike. The use of the new refractor described above will solve this problem. There may be a church, library, school or other building of the kind on the street, demanding more light than is called for in the case of residences. The dome refractor or a unit with no refractor will meet this need. At the intersection of streets, symmetric distribution is desirable, unless there are asymmetric distribution units in both thoroughfares.

Tennessee Tool Works Appoints New Dealers

The Tennessee Tool Works, Inc., Knoxville, Tenn., has announced the appointment of the following companies as dealers to handle the Ault "Traffic Line" marking machine in their respective territories: The Traffic Equipment Company, Los Angeles, Calif., for California, Washington, Oregon, Idaho, Arizona and Nevada; the Burnite Machinery Company, Denver, Colo., for Colorado, New Mexico and Wyoming; the George W. Fife Equipment Company, Indianapolis, Ind., for Indiana; the New England Metal Culvert Company, Palmer, Mass., for Massachusetts, Rhode Island and Connecticut, and the U. S. Bridge and Culvert Company, Bay City, Mich., for Michigan.

Norcross to Make Plans for Enlarged Atlanta Water-Supply

The City Council of Atlanta, Ga., has appointed Paul H. Norcross, Candler Building, Atlanta, Ga., as engineer to make plans for a new intake for the Atlanta water-supply. This is the first step toward the construction of a two-and-a-half-million-dollar water-supply and power-plant for Atlanta. The new system, when completed, will serve Atlanta for from twenty-five to thirty years without the necessity of any additions or changes, and will provide water for the development of the city from 240,000 to 500,000 people. Money for the initial work is already in the city treasury from a previous bond issue.

Lessen the Toll of Traffic Accidents

Traffic accidents each year are claiming a bigger toll than all the American casualties of the World War. According to recent figures, traffic claimed nearly 700,000 victims killed and injured in a single year. Of this enormous total, 22,631 lost their lives in what are classified as preventable accidents. During the last year the Cyclone Fence Company, Waukegan, Ill., has developed a roadway fencing, known as Cyclone Road-Guard fence, which acts as a large, elastic net, catching cars that leave the road and preventing them from

THE MULTI CONTROL STANCHION

There is no signal unit now existing that has the flexibility and power to take care of any traffic difficulty in as capable a manner as a multi angle control stanchion. This type can be used to control traffic at a "Y" intersection or at one with six approaches by merely adding to or substracting from the number of sections. As many sections are needed as there are approaches to the intersection. Any angle of intersection is met by horizontal adjustments of the separate units. Where there is a down or up grade approaching the crossing, these sections may be bent forward or pushed backward so as to meet the grade squarely.

Below these adjustable sections is an inverted bowl, the lights therein illuminate the base of the stanchion. The globe enclosed light at its top serves to convert the stanchion into a beacon at night.

The body of the stanchion is of aluminum. Only bronze screws, locks and fittings are used throughout because of their weather resisting properties. All Horni Signals are built not only with the idea of controlling traffic efficiently, but also of giving day and night service without interruption through a long period of years.

HORNI SIGNAL MFG. CORP.

145-155 FRELINGHUYSEN AVE.

NEWARK NEW JERSEY

A DANGEROUS CURVE PROTECTED WITH ROAD-GUARD WIRE FENCE

plunging down embankments. It is designed especially for use at dangerous curves, along steep embankments, and at bridge approaches, to replace the present inadequate and dangerous wooden fence which is used so widely. It is made of heavy link chain fabric and gives under stress of collision, acting as a spring. Thus a car is brought to a comparatively gentle stop, greatly minimizing the danger of fatal accident and complete wreck of the car.

This Road-Guard fence is made of Cyclone "Galv-After" fence fabric, which is heavily zinc-coated after weaving. This product is given a zinc coating approximately five times as heavy as that applied to ordinary fabric made from commercial wire, galvanized before weaving. It effectively resists corrosion and does not require annual painting. The zinc coating gives the fence a natural silvery white finish which makes it stand out sharp and clear at night when illuminated by automobile headlights.

This Road-Guard fence when damaged is easily and quickly repaired by removing picket wires. One man with a few tools can take care of any ordinary repair job in a short time. It is built of No. 6 gage wire in the standard height of 24 inches for erection on fences 36 inches high and on sturdy wood posts.

A Police Mace and Billy with Tear Gas

The use and value of tear gas in police work is only beginning to be appreciated and many of the larger police departments as well as members of the state constabulary, penitentiary and county officers of the law are being equipped with the Federal mace and billy, which includes a tear gas chamber. This equipment is made by the Federal Laboratories, Inc., Westinghouse Building, Pittsburgh, Pa.

The mace in appearance is the same size, weight and general contour as that of the standard police mace or night stick and can be used as such. It has, however, the additional feature that when it is pointed at a man or group of men and the button pushed, a cloud of tear gas is projected from the end for a distance of from 20 to 30 feet, sufficient in volume to render helpless any one within that range. The charge is much like a shot-gun shell and is easily installed. The billy is like the mace, with the exception of the barrel, which is shorter, and it functions the same as the mace.

This equipment is also made in the form of hand grenades, which can be used for dispersing a mob, preventing property damage by rioters and driving barricaded criminals from cover. One Federal hand grenade will stop a mob of hundreds in an 80-foot street. Thrown into a large hall, it will cause every occupant to vacate hastily. It is simple in construction and will not explode, is foolproof and weather-proof, and is provided with a safety device so that it can be stored indefinitely.

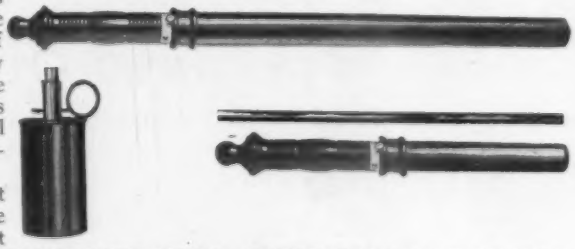
Dixon Moves Boston Office

The Joseph Dixon Crucible Company, Jersey City, N. J., has announced the removal of its Boston office from 49 Federal Street to 80 Federal Street, the new Chamber of Commerce Building. The staff of the Boston office consists of H. A. Nealley, District Representative, looking after lubricant and paint sales; Guy W. Hart, and Wm. E. Haggerty, pencil sales; Charles A. Shaw and R. H. Brinkerhoff, crucible sales, and J. W. Loftus, lubricant and paint sales.

An Ordinance on Oil Burning

MORE than a year ago the American Association of Oil Burner Manufacturers sent to the cities of the United States that were without ordinances on oil burning a letter offering to give them a copy of satisfactory ordinances in effect in other parts of the country. Requests for these ordinances are still being received.

Any city which is considering an ordinance on this subject may secure from Leod D. Becker, Executive Secretary, American Association of Oil Burner Manufacturers, 518 Bank of Galesburg Building, Galesburg, Ill., a copy of an ordinance which the Association considers as nearly satisfactory and just as can be worked out.



POLICE MACE AT TOP. LEFT BOTTOM, HAND GRENADE, HEIGHT 4½ INCHES. RIGHT, BILLY

Highway No. 12—
Cologne, Minn.

Standard Asphalt Road Oil No. 4 Was Used

THERE are no city streets or country highways which, in beauty, long wearing qualities, economy and general excellence, can compare with those properly constructed of asphalt. However, funds are not always available for the building of such excellent roads and less expensive materials must be used.

Where this condition exists and where good, but low cost, streets and highways are desired, Standard Asphalt Road Oil is the product to which road commissioners and engineers naturally turn.

These asphalt road oils possess those characteristics which time and practice have demonstrated to be most desirable. Where they are used, the dust nuisance is immediately eliminated. This fact, coupled with the water-proofing effect of the asphalt road oil, also puts an end to muddy streets. The application, year after year, builds up a remarkably smooth surface of great toughness and durability. The road to which Standard Asphalt Road Oil has been properly applied gives splendid service every day in the year.

With the great road building program mapped out for the country this year, there is certain to be a great demand for these products and those who delay making contracts may find it difficult to secure the products they want. It is advisable to arrange contracts now to cover your year's requirements.

Now, as always, the services of our staff of engineers attached to our Road Asphalt Department are at your disposal. Their services are rendered free of charge and the beneficiaries of it are placed under no obligation to us.

We suggest that you get in touch with our Road Asphalt Department at once, with reference to your requirements for 1925.

STANDARD OIL COMPANY

(INDIANA)

General Offices: 910 S. Michigan Avenue CHICAGO, ILLINOIS

ILLINOIS	INDIANA	IOWA	S. DAKOTA	N. DAKOTA	MINNESOTA	MISSOURI
Chicago	Evansville	Davenport	Huron	Fargo	Duluth	Kansas City
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Joliet	South Bend	Mason City	MICHIGAN		Minneapolis	St. Louis
Peoria		Sioux City	Detroit	WISCONSIN		
Quincy	KANSAS		Grand Rapids	La Crosse		
	Wichita		Saginaw	Milwaukee		

When writing to Advertisers please mention THE AMERICAN CITY—Thank you.

MOTOR MOWERS IN LINCOLN PARK, CHICAGO

Modern Methods for Mowing and Rolling Park Lawns

Of the many changes in work and methods in recent years, the use of power lawn-mowers with light rolling at the same time is probably the most important for securing and maintaining smoother and better lawns and consequently finer appearance in parks and about municipal buildings. If a lawn is poor, no other improvement will make a fine appearance. On the other hand, notwithstanding the surroundings, a fine lawn is always pleasing. Since power lawn-movers are coming a fine appearance. On the other hand, notwithfrequently and at proper times is much simpler and easier. As the work can be done so much quicker, mowing can be done often and, with the light rolling at the same time, the lawns are always maintained smooth.

Many expert gardeners place great stress on this rolling feature for securing the best results, beginning early in the spring while the ground is still soft, using the power outfit for rolling only before the grass is long enough to cut. Also, some use special trailing rollers on which the operator rides, giving double rolling each time the lawn is mowed. The light rolling early in the spring presses the roots of the grass and the soil firmly together after the winter's freezing, and the continued light rolling when mowing keeps the ground smooth, dry and hard in the summer or fall. One important thing is that, except when using a machine for rolling only, the advantages of light rolling are secured without additional time and expense over that required for mowing.

The accompanying illustration shows the method adopted in a park in Chicago where six machines, made by the Reed Motor Lawn Mower Company, 1332 West Lake Street, Chicago, Ill., are used. In Lincoln Park, where this picture was taken, there are some open spaces and also a great many obstructions, such as trees, shrubbery, flower-pots, lagoons, walks and driveways, to be avoided or mowed around. The machines, however, are very flexible and suitable for all conditions, so that very little trimming with hand mowers is necessary. When walking over a lawn cared for in this way, the difference is appreciated, not only in appearance, but in comfort in walking, due to the absence of lumps or bumps which so often develop and remain in lawns that are not rolled frequently.

Water Works Manufacturers Association to Entertain at Louisville Convention

The annual convention of the American Water Works Association is to be held at Louisville, Ky., April 27-30. M. F. Tiernan, President of Wallace & Tiernan Company and President of the Water Works Manufacturers Association, has appointed the following entertainment committee: Burt B. Hodgman, Chairman, National Water Main Cleaning Company; E. A. Murphy, Wallace & Tiernan Co.; Cyrus Byrd, Pitometer Company; John Ward, Vice-Chairman, Rensselaer Valve Company; W. R. James, Mueller Manufacturing Company; E. L. Cantrell, Neptune Meter Company; Theodore R. Kendall, THE AMERICAN CITY.

The Committee has arranged for a reception and dance at Brown's Hotel, Louisville, Ky., on Monday evening, April 27, in charge of Messrs. Byrd and Murphy. A smoker will be held on Wednesday evening, April 29, at the Seelbach in charge of Messrs. Ward and James. A theater party is being arranged for the ladies on the evening of the smoker, by Mr. Murphy. A dinner dance will be held at the Hotel Seelbach on Thursday evening, April 30, in charge of Messrs. Kendall and Cantrell.

New Foamite District Offices

The Foamite-Childs Corporation, Utica, N. Y., has announced the opening of several new district offices. The new office in Jacksonville, Fla., will be located at 201 Peninsular Casualty Building and will serve most of the state of Florida and the southern part of Georgia. This office is in charge of Herbert G. Norton, District Manager, who will warehouse a complete stock of Foamite-Childs products in Jacksonville. Another district office has been opened at 1032 Munsey Building, Washington, D. C.

James M. Castle, Inc., sales and engineering representative for Foamite-Childs at Philadelphia, has moved from 1212 Arch Street into larger and more convenient ground-floor quarters at 1718 Vine Street.

The New York City district office has been moved up town from the former location at 183 Varick Street, and is now located in the Greeley Arcade Building at 128-136 West 31st Street.

Foamite-Childs interests in Ohio and Kentucky, formerly handled by the Scallan Supply Company, are now being directed by the Fire Equipment Corporation, with offices at 19 East Central Parkway, Cincinnati, Ohio. This company also maintains branches at Cleveland, Toledo and Columbus, Ohio. The personnel of the new Cincinnati office includes D. H. Reedy and C. E. Schultz, who are well known as fire protection specialists in this territory.

SEND TODAY FOR THIS NEW BOOKLET!

Solvay Flake Calcium Chloride has been approved by engineers wherever it has been used and is today recognized as a necessary material for concrete curing.
It is for use in all concrete work, and for use in mortar, in setting brick. Its efficiency is not impaired by the weather. The action of Solvay enables brick work and concreting to proceed at exceptionally low temperatures, as it lowers the freezing point of water, at the same time hastening the action. Because it is used integrally, Solvay hardens the entire mass and not just the surface.

***For* CONCRETE CURING**

***use* SOLVAY**

FLAKE

Calcium Chloride

ACCELERATES, HARDENS, FREEZEPROOFS—WATERPROOFS CONCRETE

Shipped in 375 lb. non-returnable drums or easy-to-handle 100 lb. moisture-proof bags from 75 convenient distribution points. Our new booklet No. 1051 "Concrete Summer and Winter" sent free on request.

THE SOLVAY PROCESS COMPANY

WING & EVANS, Inc., *Sales Department* 40 RECTOR ST., NEW YORK

PERMANENT MARKER FOR MEMORIAL SQUARE

An Everlasting Memorial Marker for World War Heroes

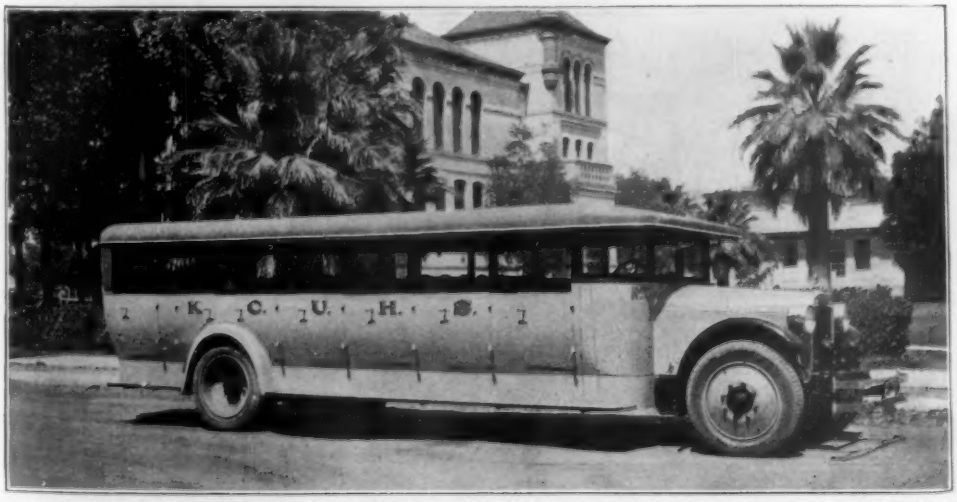
Memorial markers have been used very generally in connection with memorial trees and in the renaming of streets and squares for those lost in the Great War. Various methods have been employed to record the names of those who made the supreme sacrifice. Giving proper individuality to these memorials is one of the problems facing many communities. The accompanying illustration shows the form of memorial tablet or sign made by the Century Sign Company, 100 Colonial Road, Boston, Mass. In this instance a small Square was named. Sometimes it is a more or less prominent street in a section chosen for this purpose. The gold star at the top entwined with oak leaves and acorns carries the approved emblem for this memorial.

Contrast in Motor-Busses for Transporting School Children

The two accompanying illustrations provide a wonderful study for municipal officials to consider in motor transportation contrasts. The small one is reproduced from a photograph taken only 18 years ago when gasoline bus travel was in its infancy, and the other shows a new motor coach, modern in its design and appointments. Both vehicles were made by the International Harvester Company, 606 South Michigan Avenue, Chicago, Ill. The older one was called an auto buggy and was built about 1907. It was operated by a two-cylinder engine and chain drive. The influences of the horse-drawn vehicle are very apparent in its make-up, especially its high wheels. In fact, the auto buggy was nothing more than an adaptation of the old spring-back hack. It carried from eight to ten passengers.

The new International coach shown in the large illustration has recently been put into operation for transporting students to and from the Kern County, Calif., Union High School and is a powerful six-cylinder vehicle carrying from 28 to 33 passengers.

AN AUTO BUGGY OF 1907



NEW MOTOR-BUS USED FOR TRANSPORTING STUDENTS OF THE KERN COUNTY, CALIF., UNION HIGH SCHOOL

Thus Dust is Banished and Concrete Curing Simplified

WHAT'S the use of pumping water and piping or hauling it long distances when it will *come* to you, in the necessary quantities, all by itself, if you use *Dowflake*.

Dowflake attracts moisture like a magnet attracts a needle, and *Dowflake* holds for weeks the moisture it attracts.

So, when you put *Dowflake* on a gravel or stone road you get immediate action, and continuous dust control for a long time. With moisture in the road surface you cut maintenance costs in two—you can shape the road at any time and you save half the resurfacing expense. Its use is now standard with road officials in progressive communities all over the country and in Canada.

Dowflake, through its moisture absorbing properties, simplifies pavement curing. It does a better job than the old-fashioned ponding or earth or straw covering methods that were so extravagant with both time and labor. One man cures the day's mixer run in an hour with Dowflake—and there's nothing left on the pavement to clean off or carry away.

Get our Handy books "How to Maintain Roads" and "How to Cure Concrete", each is chock full of information that road men and contractors need every day. Clip the coupon and mail it now.

THE DOW CHEMICAL COMPANY
143 Water Street Midland, Michigan

Branch Sales Offices:
90 West Street, New York City
Second and Madison Streets, Saint Louis

KEEP ROADS UP AND TAXES DOWN WITH
DOWFLAKE
CALCIUM CHLORIDE

Comments on Dust Prevention

"Petitions were coming in every day from the people to have it used on their street."

* * *

"It is my opinion that *Dowflake* will pay for itself in the saving of surface which would otherwise blow away."

* * *

"It saves scarifying and resurfacing."

* * *

Concrete Curing

"In building thirty and one-half miles we made daily runs of from 1000 to 2000 feet and each day's run was cured the next morning by 10 o'clock with *Dowflake*."

* * *

"No contractor can afford to use pond or earth when your material is available."

Send for The Books

THE DOW CHEMICAL COMPANY
Midland, Michigan
143 Water Street

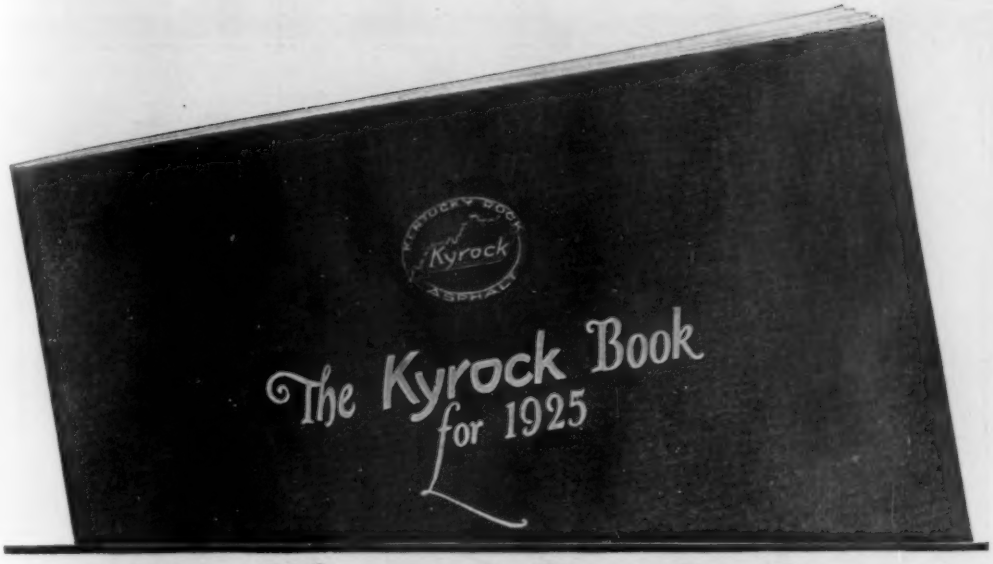
Please send me booklet indicated below

☐ "How to Cure Concrete" ☐ "How to Maintain Roads"

Name _____

Address _____

_____



The New Kyrock Book is Ready

The 1925 Kyrock Book tells the story of Kyrock from the hills of Western Kentucky to the finished pavement-quarrying, milling, transportation and road and street construction. Thirty-five interesting illustrations. This is a book every engineer will want for his files, and one in which all road and street officials will be interested. Your copy is ready. Write for booklet A. C.

Kentucky Rock Asphalt Company

Incorporated

712-718 Marion E. Taylor Bldg. **Louisville, Ky.**

Canadian Office: Canada Permanent Bldg., Toronto

When writing to Advertisers please mention THE AMERICAN CITY—Thank you.

And Then You Come to the Ruts and Bumps

Out in the country you drive with comfort and safety for miles and miles on Concrete Boulevards.

Then you come to the city limits—and from the true, even surface of the Concrete Highway you jolt on streets full of bumps and ruts.

Such streets greatly increase your gasoline and repair bills, and play havoc with your tires. And their high maintenance soon makes their cost much greater than concrete pavement.

Your city officials are ready to give you the kind of streets you want. But they know that such public works as paving programs require time for planning and financing.

Tell your local authorities you are willing to back them *now* in building more Concrete Streets.

PORTLAND CEMENT ASSOCIATION

A National Organization to Improve and Extend the Uses of Concrete

Atlanta	Denver	Los Angeles	New York	Salt Lake City
Birmingham	Des Moines	Memphis	Oklahoma City	San Francisco
Boston	Detroit	Milwaukee	Parkersburg	Seattle
Charlotte, N. C.	Indianapolis	Minneapolis	Philadelphia	St. Louis
Chicago	Jacksonville	New Orleans	Pittsburgh	Vancouver, B. C.
Dallas	Kansas City		Portland, Oreg.	Washington, D. C.

For Big Trucks and Heavy Loads

THROUGH dirt, mud and sand, up grades and out of excavations, the powerful Firestone Double-Traction keeps trucks on the move. There are eighty massive cogs to dig in and take hold.

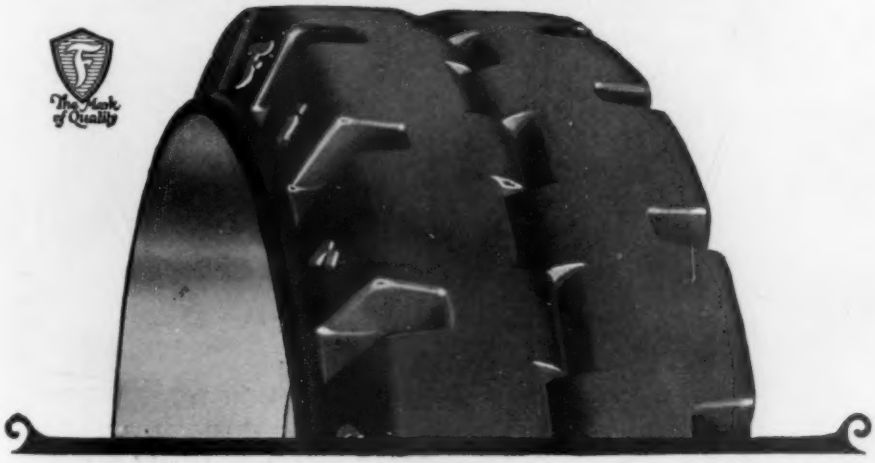
Double-Tractions stand up to the hardest punishment—giving truck and load full protection far beyond operating life of average tires.

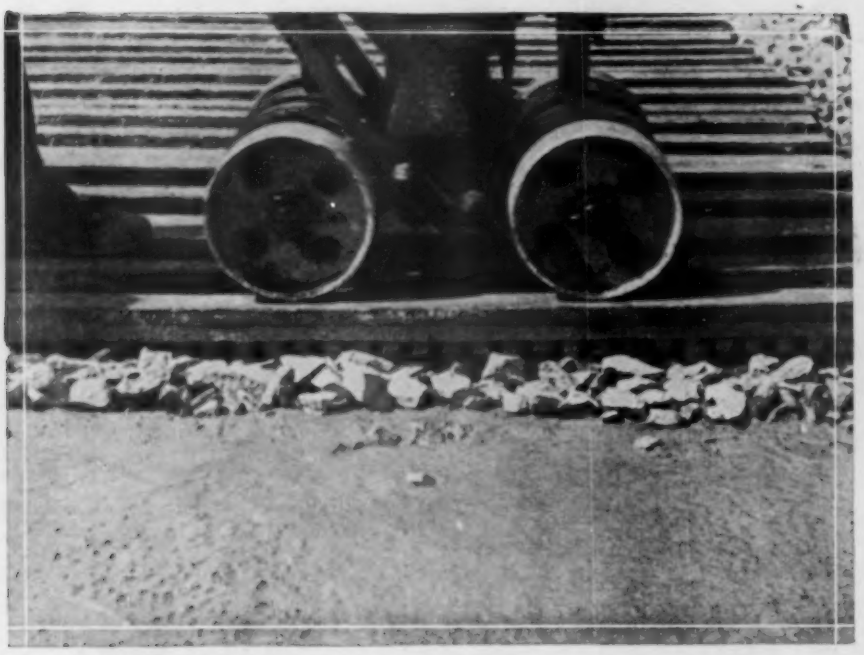
Consult the nearest Firestone Truck Tire Service Dealer. Let him apply the correct size Double-Traction tires to your truck and reduce your operating costs.

MOST MILES PER DOLLAR

Firestone

DOUBLE-TRACTION





Large stone being forced into the concrete surface and gradually lost to sight under the vibrator working over the platforms.

THE Vibrolithic METHOD

Can be used by any contractor with standard materials and equipment to "Armorplate" Portland Cement Concrete Pavement—Bids are strictly competitive.

Vibrolithic is not a material. It is a mechanical process of "Armorplating" Portland Cement Concrete Pavement. Vibrolithic does not introduce new material, delay the work or make costly demands on the contractor.

Vibrating machines, transmitting under extreme pressure 1,500 impulses per minute, impress a coating of hard crushed stone, cubical shaped with flat faces uppermost, into plastic concrete, right at the plane of wear.

Besides forming an "Armorplated" wearing surface, the coating of hard crushed stone displaces entrapped air and excess water, resulting in a thorough compaction of the concrete, all in the same operation.

The Vibrolithic Method produces extreme density of concrete (high volume of coarse aggregate and less mortar) and higher beam strength of slab, consequently greater resistance to contraction, expansion and impact, reducing cracking and surface wear.

Usual methods of preparing the subgrade, proportioning and hauling the materials, mixing and placing concrete, are employed. After the concrete has been placed on the subgrade and properly struck, a specified quantity of clean crushed hard stone is spread over the "struck" surface. This material is the medium through which compaction is obtained and it becomes the wearing surface of the pavement. Flexible gum wood platforms, placed side by side, rest on the cast material. Vibrators, powered by gasoline motors, operated over and along the platforms, both longitudinally and crosswise, deliver 1,500 impulses per minute to the fresh concrete. Each downward impulse is equivalent to a 700-pound blow.

The surfacing stone is forced into the concrete, forming the wearing surface, without increasing the thickness of the pavement or removing from the concrete any cement or other valuable ingredient of the mixture.

Vibrolithic produces maximum strength, because it is uniformly compact throughout the slab.

Write for Moving Picture Booklet A showing Progressive Steps in the Vibrolithic Method

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This winter, when the roads and streets are covered with snow and ice, your trucks will need Kelly Kats.

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They will need Kelly Kats to cushion the delicate mechanism of the engine and protect it from the destructive pounding of frozen roads.

They will need the wear-resisting qualities of Kelly Kats to withstand the punishment of sharp-edged ice and jagged frozen ruts.

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The King's Crown Plaster Company, of Cedar Rapids, Iowa, one of whose trucks is pictured above, recently wrote: "After trying various makes of tires for our trucks, we have standardized on Kelly Kats. They give us good service and better traction than any other tire we ever used."

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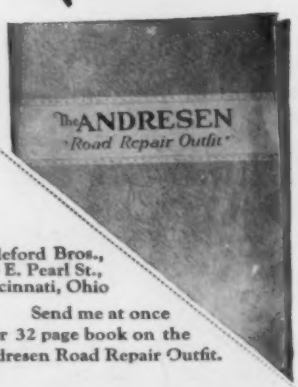

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